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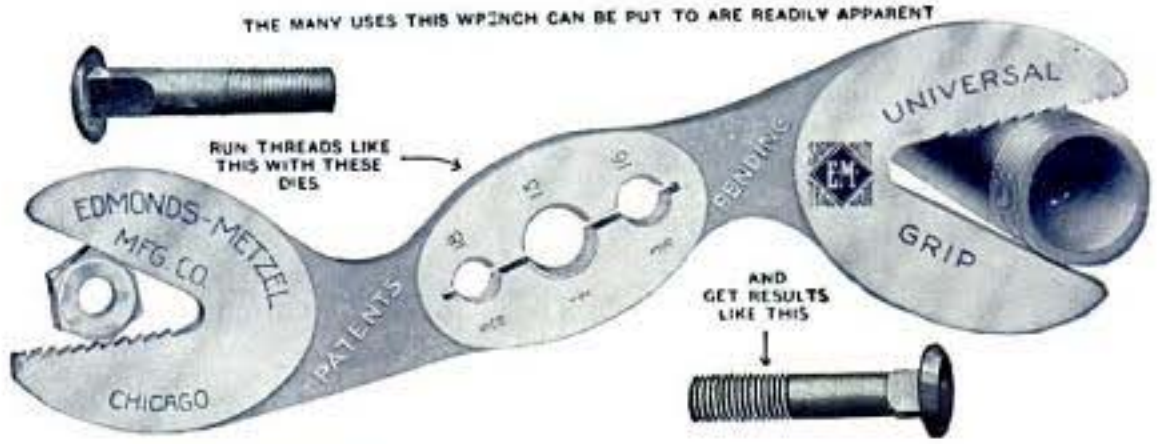

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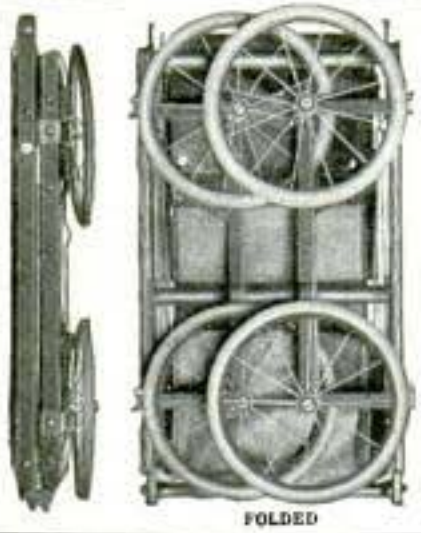

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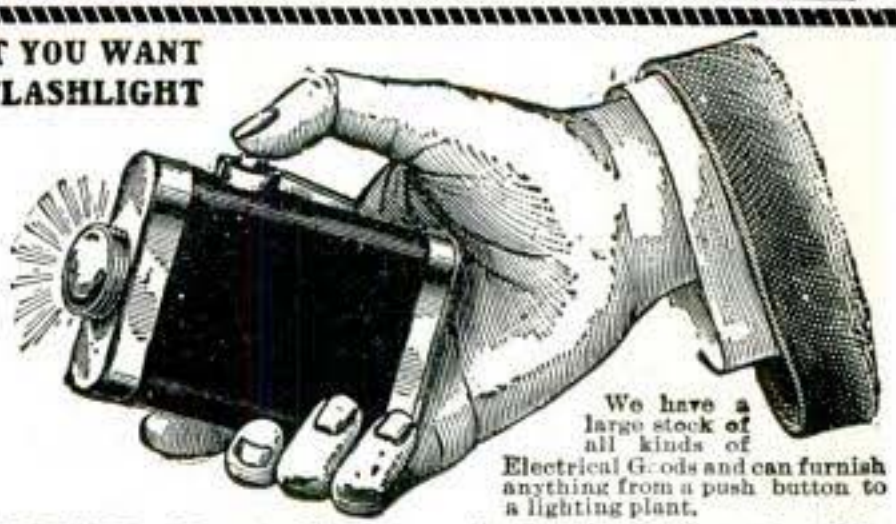

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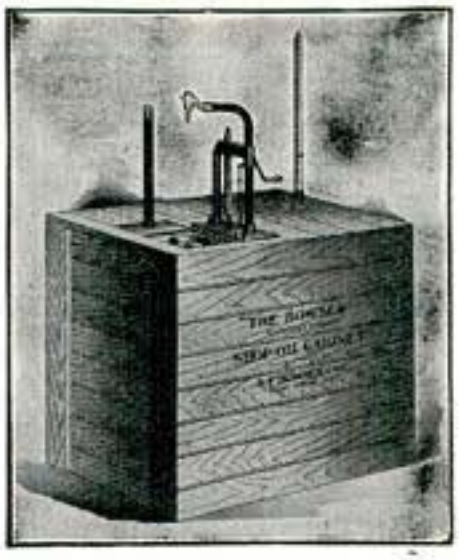

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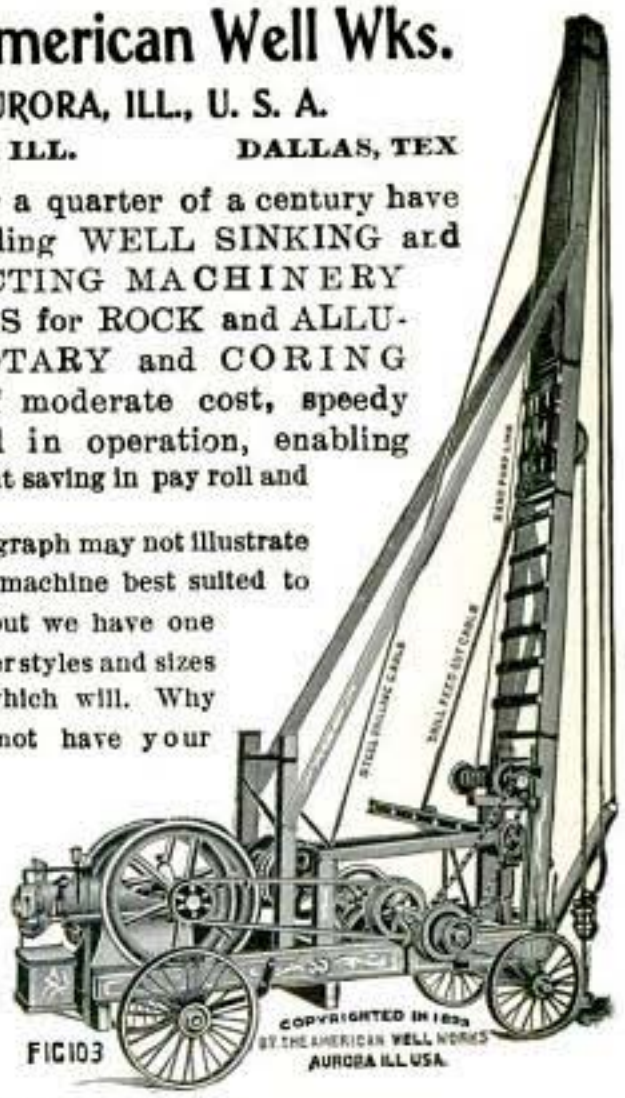


POPULAR MECHANICS

Vol. 7. No. 3. CHICAGO, MARCH, 1905. 10 Cents a copy. $1.00 a year

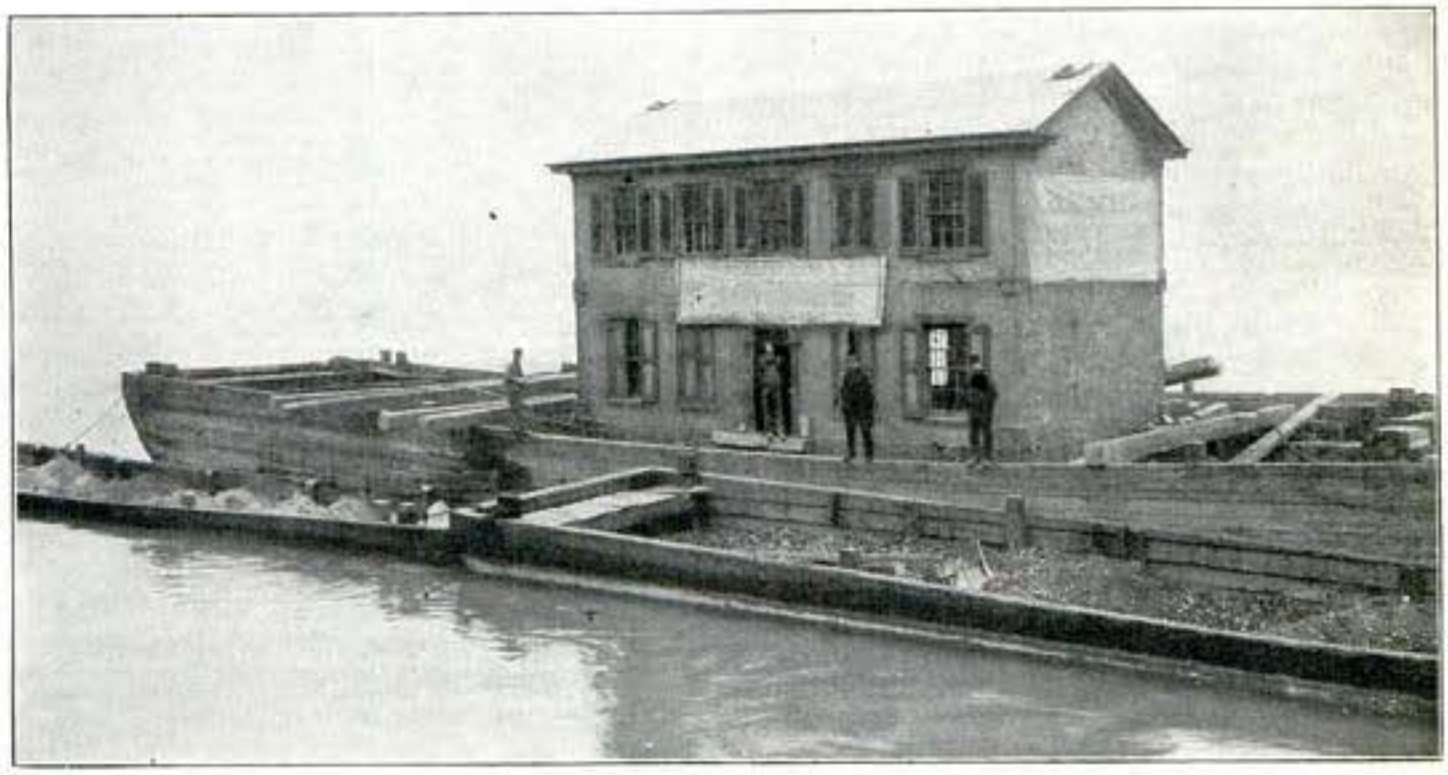
Floated a Brick House Down the Allegheny River.

Passed Through Storm and Flood, Over Locks and Under Low Bridges, but Fell Not.

A two-story brick house, sixty years old and weighing over two hundred tons, was recently moved from Sharpsburg, Pa., a suburb of Pittsburg, down the Allegheny river for a distance of five miles to the plant of the H. J. Heinz Company at Pittsburg. Aside from the age and structure of the house the moving was effected against seemingly insurmountable obstacles and was certainly a feat of its kind.

The house was lifted by means of jacks and placed on blocks and rollers. From the very outset great difficulties were encountered. Between the house and the river was 800 feet of soft, marshy ground, apparently without bottom, and every moment it seemed that the old building would collapse. When the water's edge was at last reached the movers heaved a sigh of relief, though the worst was yet before them.

Before anything further could be done a severe flood rose and swept the country, dooming many buildings in its path. The old brick house was surrounded by seething, pounding waters to a depth half way to its second story, and stood midstream and almost inaccessible. The blocking and rollers were weighted down with steel rails and immense beams to prevent its being washed away.



Towing a Brick House Down the Allegheny River

At last the waters abated sufficiently to permit the work to proceed. The house was moved down the river bank and lowered upon a huge coal barge.

The barge was fifteen feet below the level of the bank upon which the house stood.

Ready to Move

Huge blocks and timbers placed in rows rested on jacks in the bottom of the boat. A temporary foundation was built upon this and when the top was on a level with the bank, a bridge was built extending from the land to the boat. Over this bridge, the house was rolled and then it was slowly lowered until it rested upon the bottom of the coal barge. Then slowly the downstream trip proceeded, the barge being towed with great caution. Strong steel cable bands girdling the walls protected the old house from shocks.

In the four-mile trip there were four low bridges which must be passed under, and in each instance it was necessary to scuttle the barge. That is, the barge was sunk to a sufficient depth to allow the house to pass under clear of the bridge, by letting in sufficient water for the purpose. After passing under the bridge the water was pumped out. At one bridge the house had to be lowered six feet. The next excitement was met in lowering barge and house through a lock. This was successfully accomplished and the river trip completed without disaster.

In the final move to its new location it was necessary to cross the three tracks of a railway system in just one hour. This close time schedule was conformed with, and an exceptionally clever piece of work was finished without further adventure.

The old brick house had at one time been the homestead of Mr. H. J. Heinz's parents and the business of the company was started in it in 1869, and it was moved purely as a matter of sentiment. The house was built in 1854 by Mr. Heinz's father, who was at that time a brick manufacturer and general contractor. The work of moving it began on the second of one month and was completed on the fourteenth of the next, a little over one month's time.

Moving onto a Coal Barge

MORE OFFICERS FOR THE NAVY.

The number of officers assigned to United States ships is only about half the number assigned to vessels of the same class in English, French and German navies, and is inadequate, says Rear Admiral George A. Converse, chief of the Bureau of Navigation. Admiral Converse says that unsatisfactory and dangerous conditions arise from having too few officers; that some of our battleships have lieutenants as ordnance officers and others have ensigns and midshipmen as watch and division officers. He recommends that the number of lieutenants be increased from 350 to 600 and the number of lieutenant commanders from 200 to 300.

CONSUMPTION OF RUBBER GREATER THAN ITS PRODUCTION.

Last year 60,000,000 pairs of rubber boots and shoes were manufactured and sold. This is a single item in the demand for a great commercial commodity which enters into the composition and construction of thousands of necessary articles. The demand for rubber has been increased by many tons in recent years by its use for vehicle tires.

It is said that the production of rubber is increasing rapidly and yet not in ratio to the increase in its consumption. Consequently prices are going up, and rubber costs more than it ever has before, being quoted at $1.30 to $1.32½ per pound. This is a startling increase over a few months ago. In 1880 the highest price for pure Para rubber was only 50 cents per pound.

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Queer Craft That Cannot Sink

Four Sailors Six Months in Crossing the Atlantic in 18-Foot Sail Boat

The "Vraad" Cast Up On the Beach at Gloucester

"In appearance a cross between a Rugby football and a well developed hen's egg," is the way the editor of Sail and Sweep tersely pictures a most remarkable little craft. The "Vraad," built by a daring Norwegian sailor, has recently reached our shores after a stormy voyage across the Atlantic. The queer little boat is only 18 feet long, 8 feet wide, and 8 feet deep. It is built of ⅛-inch boiler plate and will carry 4¾ tons. In smooth water just one-half the boat is exposed. Just above the water line is a guard rail such as seen on towboats and steamers; this reduces the rolling motion; she also carries a centerboard. The helmsman is stationed below deck; in fact the crew seldom come out of the "hold," for to do so would mean being swept off into the sea. The interior is padded, and during severe storms the men cast themselves into bunks to prevent being pounded to a pulp.

The one mast is of hollow steel, 20 feet long; the sail spreads 250 square feet. Capt. Abe Brude, who designed and built the craft at a cost of $600, says they left Norway on June 27, 1904, and were washed up on the beach at Gloucester, Mass., during the great storm on January 7, 1905. A few days before this unseamanlike landing was made, the "Vraad" unshipped her rudder, and the crew could do nothing in the way of repairs or steering with an oar on account of the storm. The boat was uninjured and had not leaked a drop when the crew emerged on the beach when the tide went out.

A new carbon silicide, second in hardness only to the diamond, has been discovered in the residue of molten iron from a meteor found in the Canyon Diablo, Ariz., by Dr. Henri Moissan of France. The experiments were carried on by means of an electric furnace. The new substance was named "Moissanite" in honor of its discoverer.

The Largest Turbine in the World

Weighs 182 Tons—Furnishes 10,500 Horse Power—Power Plant at Shawinigan Falls, Canada

The largest turbine in the world, 30 feet high, 32 feet 2½ inches wide, weighing 182 tons, taking 395,000 gallons of water per minute, and furnishing 10,500 horse power was recently placed in the power plant of the Shawinigan Power Company, Shawinigan Falls, Canada.

It is of the horizontal shaft type, the water entering below and flowing out through two draft tubes, one on each side. The solid forged steel shaft weighs 10 tons, is 22 inches in diameter in the middle, tapering to 10 inches in diameter on one end, and to 16 inches in diameter on the other. The shaft bearings are 27 feet apart. The rotating part of the wheel or "runner" is of bronze, weighs 5 tons and under a head of 125 to 135 feet of water makes 180 revolutions per minute.

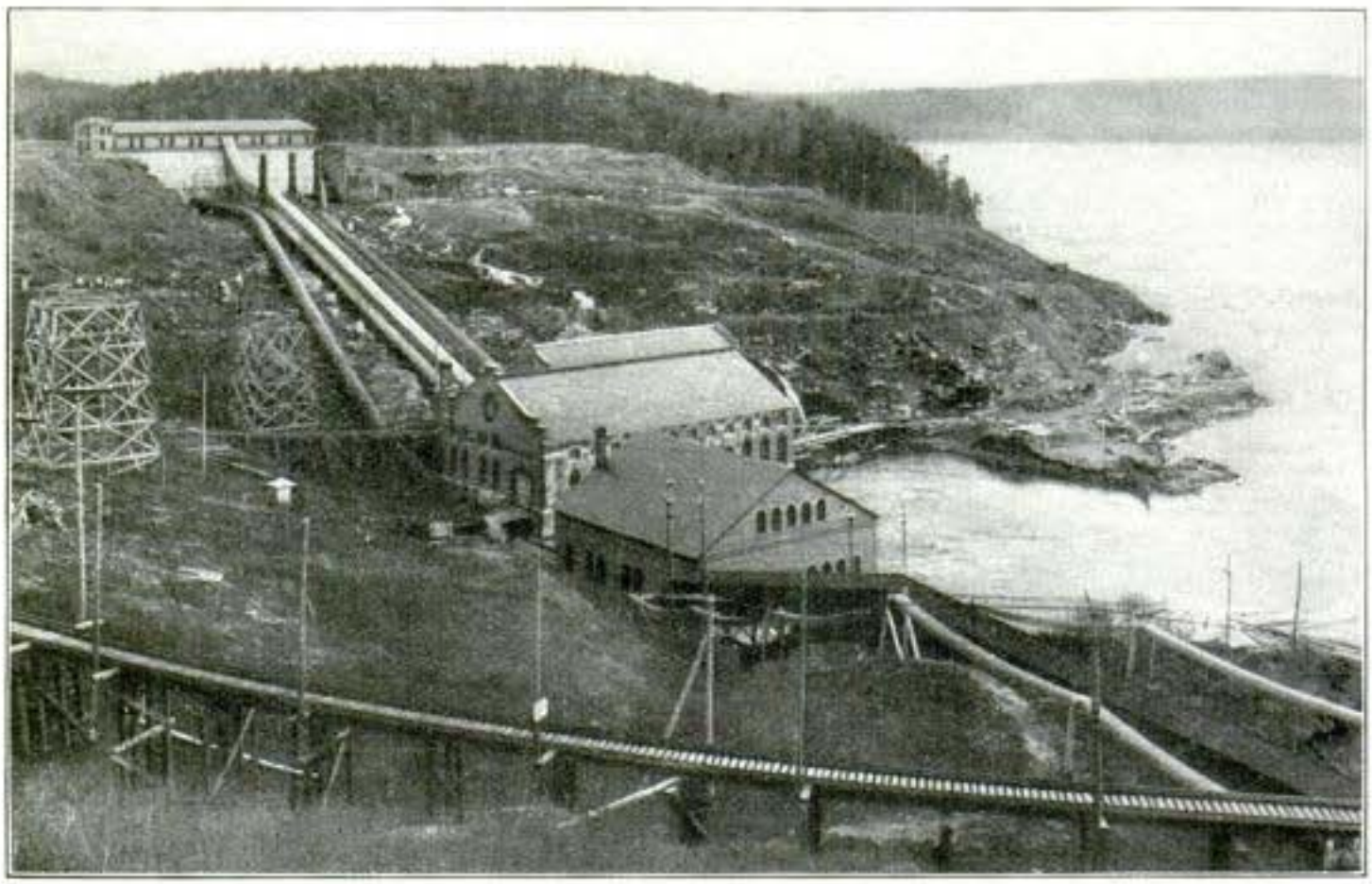
The water used for this great wheel at its full capacity would make a river 100 feet wide and 9 feet deep, flowing at the rate of 60 feet per minute. This water is received at the wheel by an intake pipe 10½ feet in diameter.

A special route with bridges high enough to allow the massive parts to pass, had to be selected for shipment and five flat cars and one box car were required to carry the turbine.

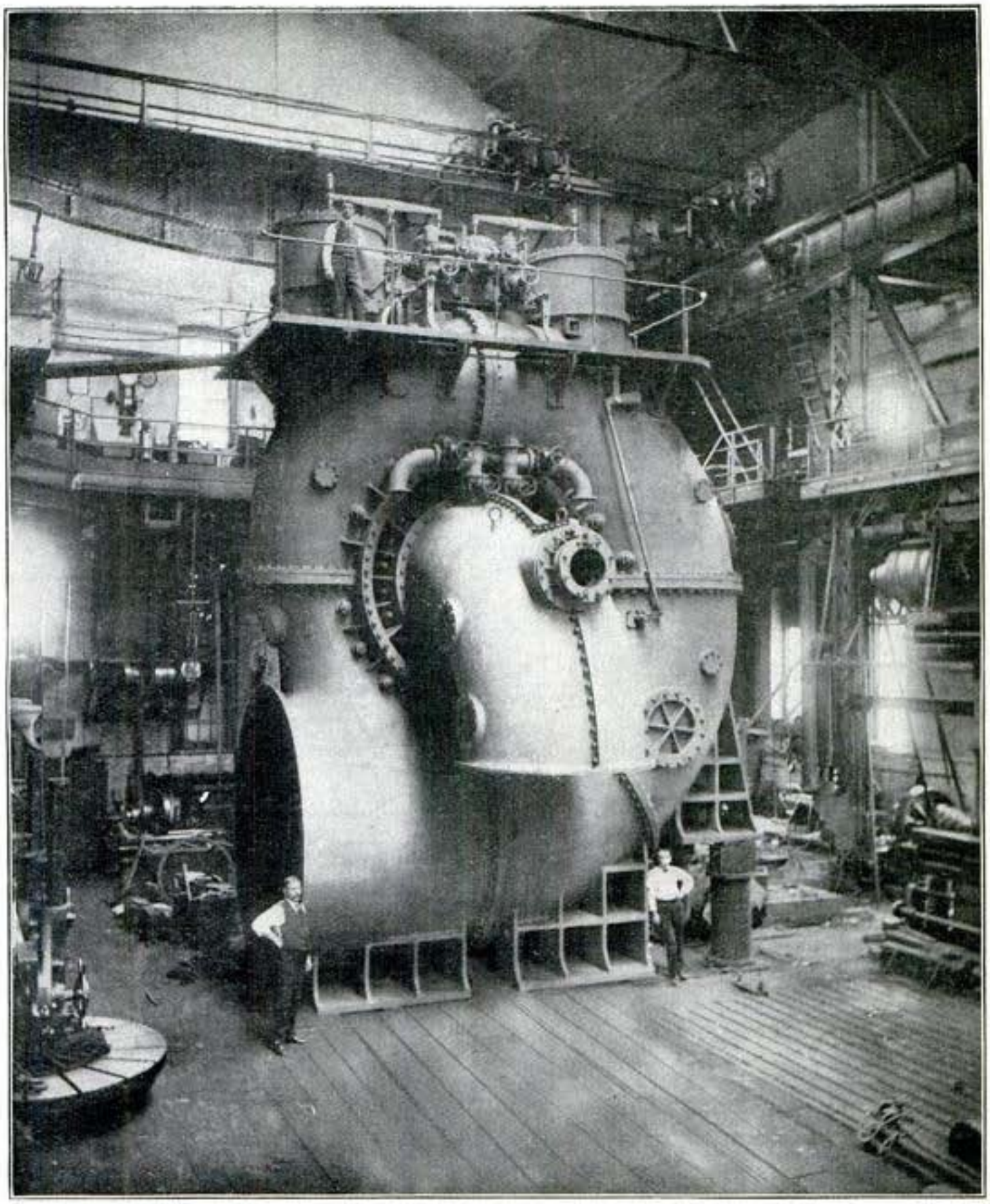
The Shawinigan Power Plant is on the St. Maurice river 84 miles from Montreal. At this point the river runs for about 1,000 feet in a channel 600 feet wide and 20 feet deep, from the upper lake to the edge of the falls; so that the power estimated from a head of 135 feet running at 3½ miles an hour is 125,000 horse power.

From a village five years ago, Shawinigan is today a city of 5,000 people. On Feb. 3, 1903, with a plant of 18,000 horse power, power was first transmitted to Montreal. In May, 1904, the 10,500 horse power turbine described in this issue was ordered, built and put in place in the short period of five months. Of the 28,500 horse power now developed Montreal gets 10,000 horse power for lighting, railways, and other power purposes.

Three overhead cables, each composed of seven No. 7 aluminum wires, carry the current, "stepped up" from 2,200 volts, quarter



Head Race, 125 Feet Above the Power House



Courtesy of the I. P. Morris Co., Philadelphia

Erecting the 10,500 H. P. Turbine in the Shop

phase, to 50,000 volts three phase. The cables are carried, one on the pole, and two on southern pine cross-arms, the poles being of cedar. The cables are fastened to insulators capable of standing 100,000 volts and are arranged in the form of an equal-sided triangle, each side being 60 inches. At Montreal from "step down" transformers the current goes to motor generators which change it from 30 cycles to 60 cycles. The loss in sending the current 84 miles when 8,000 horse power is delivered at Montreal, is a little less than 1-5 or 2,000 horse power. Another 10,000 horse power line to Montreal is being built and plans for a third are now being drawn.

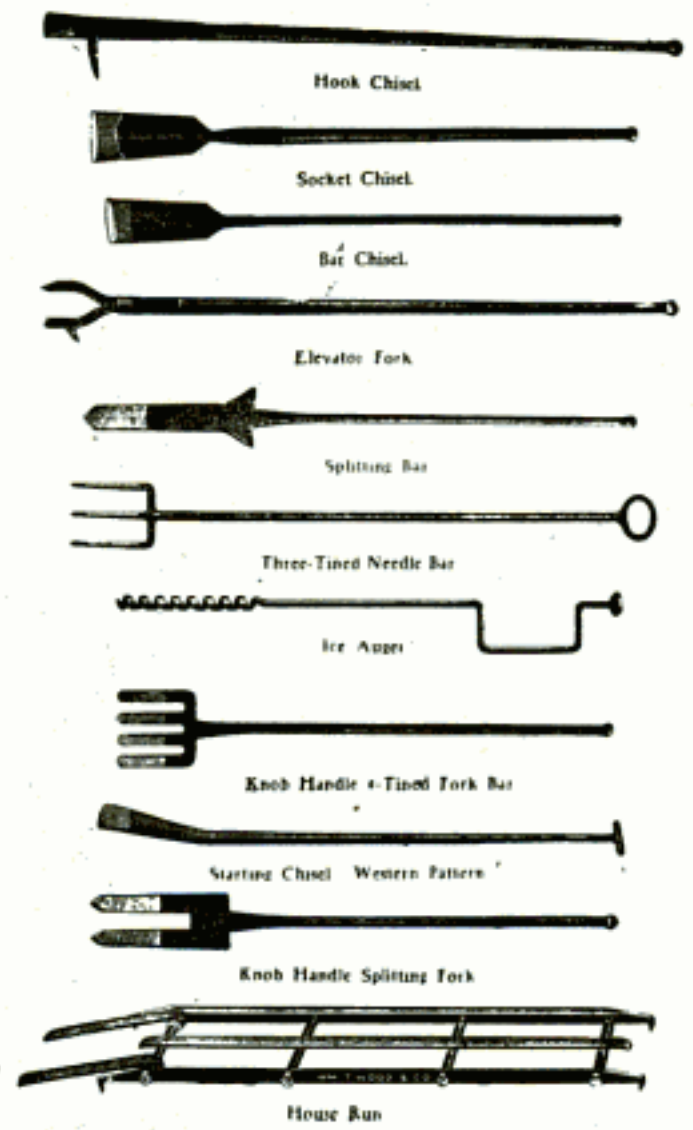
HARVESTING ICE IN THE UNITED STATES.

Millions of dollars are invested in equipment for cutting and storing natural ice, and the annual ice harvest is a crop of vital importance. The business is one about which the general public knows very little. The best cutting months are January and February, during which thousands of men and teams are very busy, even with the use of modern machinery, which has reduced the work to a science.

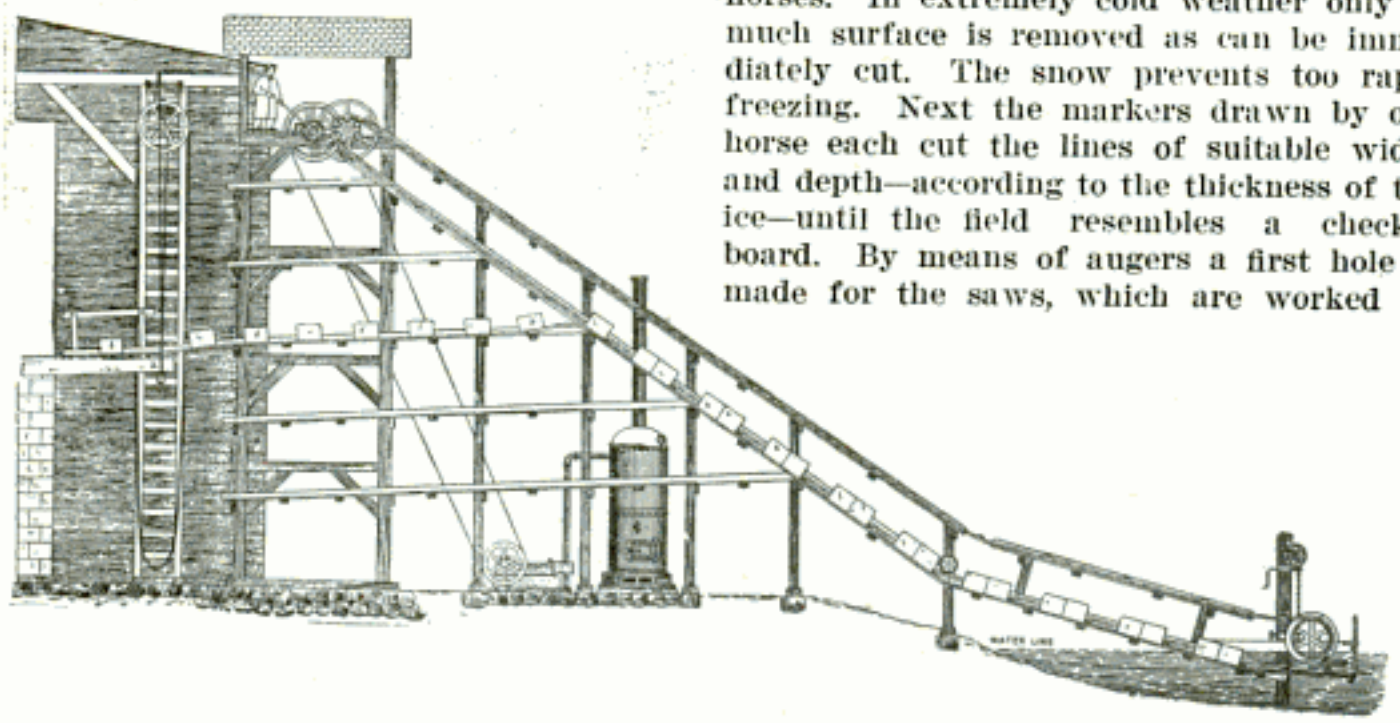
A thickness of 10 to 12 inches is preferred, and the best ice makes during a continued cold spell, when the freezing proceeds evenly and produces clear ice free

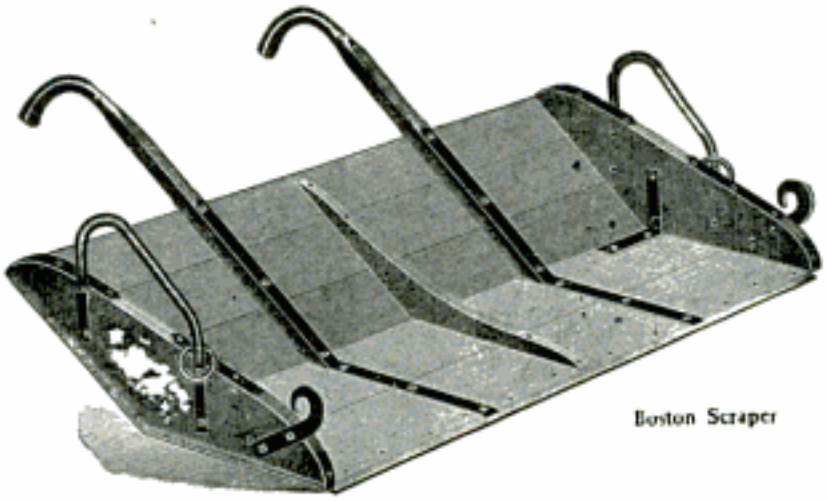
from layers of snow or surface thawings. In many plants the actual cost of cutting and housing is less than 15 cents a ton. This does not include rentals of lakes or interest on anything; simply the getting a ton of ice out of the water into the store house. The crop which has just been gathered is one of the best in many years. Large companies always carry over from year to year a certain amount to insure against a poor crop, which must always be guarded against.

In a well equipped establishment the outfit is surprisingly large, including engines, hoisting machinery, electric light plant for all night work, commodious boarding houses, horses, and hundreds of tools of an endless variety. It is possible here to show only one of a type; of tongs, for instance, there are more than fifty kinds.



The first thing is to clear away the snow, if any. This is done with scrapers and horses. In extremely cold weather only so much surface is removed as can be immediately cut. The snow prevents too rapid freezing. Next the markers drawn by one horse each cut the lines of suitable width and depth—according to the thickness of the ice—until the field resembles a checker board. By means of augers a first hole is made for the saws, which are worked by





Boston Scraper

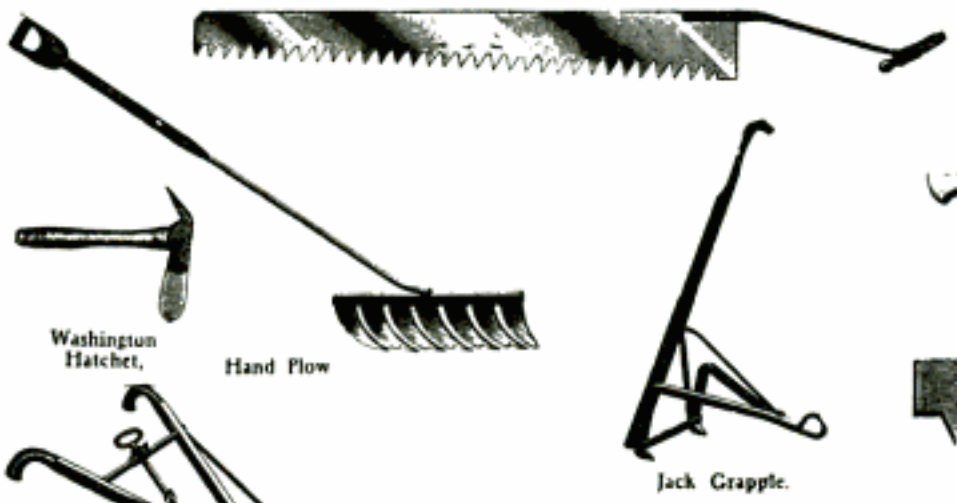
New York Hoisting Tongs

Boston Solid Claw Hoisting Tongs

Oval Iron-Handle Hand Saw

Tapping Ax

Towing Hook



Washington Hatchet.

Hand Plow

Jack Grapple.

House Ax.

Ice Cleaver or Hack

Sieve Shovel

hand. An open place is made at the foot of the incline leading up into the house, and a channel opened extending out into the field, where the crop is being cut. The cakes are floated by men using "puller" or "shover" hooks attached to poles of suitable lengths up to 18 ft. Each man has his own special duty, and the work once started, progresses with a regularity and method of a factory.

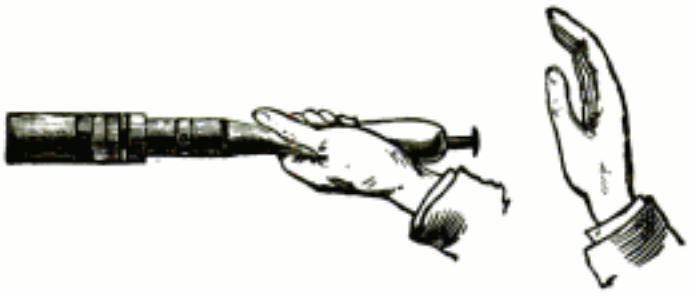
After the marker, follows the cutting plows, which cut still deeper grooves, leaving only a few inches for the men to saw through by hand. When the ice is thin the hand sawing may sometimes be dispensed with and the cakes broken off by means of separating chisels, having a steel blade 4 in. wide, 16 in. long, firmly secured at the end of a wooden handle 4 ft. 6 in. in length. The illustrations are self-explanatory.

Ice houses would seem to be immune from fire; but do, however, burn frequently, with a total loss of house and contents. The buildings seem good marks for lightning, and their location far from any fire department, renders difficult any effort to extinguish the flames, which strangely burn with intense fury and rapidity.

Night Signals Used by the United States

No International Code of Night Signals in Existence—Such System Would Safeguard Thousands of Lives.

It is a strange fact that in this humanitarian era there is no international code of night signals for use on either land or sea in existence. Stranger yet, the merchant marine of the world has no established code. Each nation has its secret plan or chart and the code book of it is carefully guarded, and arrangements made for its destruction



Igniting the Cartridge

should there be danger of its falling into the hands of an enemy. On board a war vessel the code book has a piece of lead tied to its cover so that if need be to throw it overboard it will sink.

There have been many attempts to establish a simple international night signal system. Day signaling is provided for, mirror flash signals being used for long distances and flags, disks and semaphores for short distances. In 1873, when the White Star liner "Atlantic" displayed rockets and blue lights as a distress signal and they were mistaken as a salutation to a passing vessel and the "Atlantic" was lost, the great need for a distinguishing night signal system was felt. Most steamship lines now have such a system which is registered in the government bureau, and published in almanacs, but this is far from being a satisfactory disposition of the matter.

"Signals of one or more colors in the same cartridge burning in succession," says the American Shipbuilder, "do away with any chance of failure or misunderstanding." Among such signals, what is known as the "Coston night signals," invented by Benjamin Franklin Coston in 1840, leads. The invention was not completed at that time, but was patented by the widow of Benjamin Coston in 1859.

The Coston system was arranged applicable to Marryat's numeral code of flags then in use for day signaling and the system was adopted by the United States navy, green, red and white being the colors used. The signal has been greatly improved since first constructed in 1840. It then consisted of composition fires put up in waterproof boxes. When one was to be used, the cover of the box was removed, the box placed on a board and ignited by port fire, the display being made from the surface or deck. Red, white and blue were used at that time, but after the 1859 patent, green was substituted for blue, as it was more reliable as then produced. The color compounds were then put up in cartridge cases made of tinfoil and manila paper and a quick match attacked. In its next stage the cartridge was placed on a wooden handle by means of which it was held during the display and then, in 1863, it was constructed for use in the socket of a peculiarly made pistol and ignited by a percussion cap. The United States army used this apparatus and in 1877 the United States navy adopted the Coston aerial night signal invented by H. H. Coston, late captain of the United States Marine Corps. The navy also uses searchlights and the "Adoise system," operated by a keyboard turning on and off red and white incandescent lights.

Wm. F. Coston improved the Coston signals by igniting them by means of a percussion cap and made a signal combining aerial and surface display. This was a great improvement and the signal was adopted by the United States, France, Italy, Denmark, Holland and Brazil.

Coston Improved Holder

The Coston signal is efficient in any kind of weather and can be displayed from any place, and is distinctly visible at distances of 15 to 20 miles. The United States pilot-call signal used along our coasts is white, red, white in succession, the distress signal red, white, red in succession. The Coston signals have warned hundreds of vessels and saved thousands of lives and millions of dollars worth of property.

Thermit Welding, Its Principle and Execution.

Process Has Made Practicable Long Lengths of Continuous Rails—Involves One of the Most Important Scientific Discoveries of the Age.

Thermit welding, or properly speaking, the new science of aluminothermics, is now generally conceded to be one of the most important scientific developments of the times. As a science it involves the chemical combination of oxygen and aluminum (two elements common to almost all parts of the globe) in such a manner as to produce a temperature equal to that of the electric arc. Metallic aluminum combined under the proper conditions with many another metal and ignited will reduce the other metal from its compound to its simple form. For instance, if it is combined with oxide of iron and ignited the aluminum unites with the oxygen of the oxide and forms aluminum oxide (commercial corundum) and leaves the iron free. The iron sinks to the bottom and the slag forms the upper layer.

Thermit, by means of which thermit welding is accomplished, is a patented product, obtained under this principle. The thermit so produced may be ignited in one spot and combustion will proceed throughout the whole mass, without any outside heat supply and so generate a very high temperature. The application of the heat is usually by using small crucibles for melting on the spot where the welding or repair is required.

The process is extremely simple and has reduced the time required for repairing fractures in large metal parts to a considerable degree, as the fractured part, no matter what its nature, may be repaired while in place.

The most important application of thermit so far is for welding rail joints. In modern trolley road construction the continuous rail plays an important part, being used as the path for the return current. By the use of thermit the rail ends may be welded quickly and cheaply.

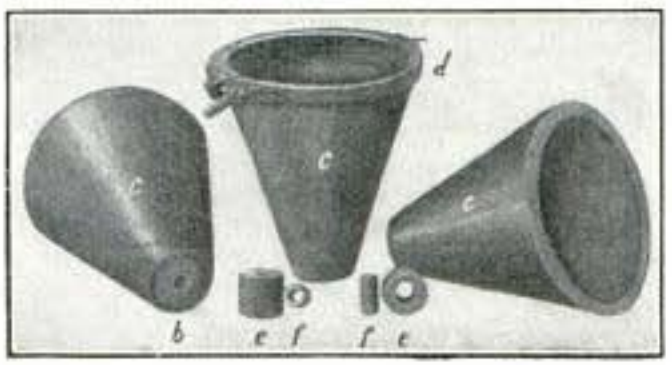


Fig. 1. Crucibles

This work has been carried on to a greater extent in Europe than in America, but has been watched with great interest by engineers everywhere. One American expert recommended it for use on an important track in Singapore, and in 1903 native laborers welded 3,000 joints and 20,000 joints were made in 1904.

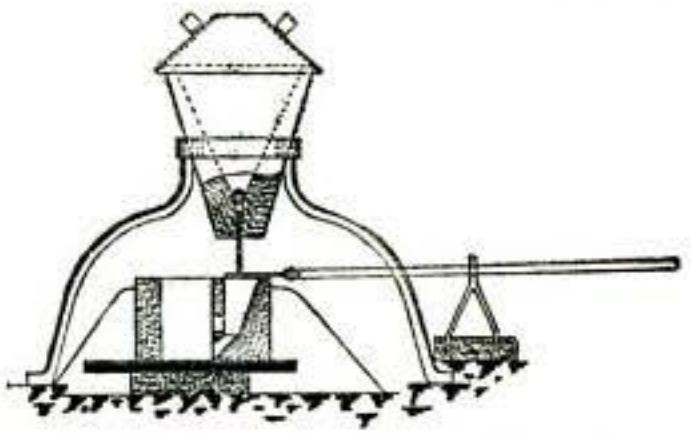


Fig. 2. Tapping Arrangement

The outfit for welding a joint includes a crucible, C, Fig. 1, consisting of a sheet-iron mantle, lined with magnesia. Many trolley companies using thermit for welding on a large scale manufacture their own crucibles. To do this the lining is tamped around a cone suspended in the middle of the mantle and the crucible, with the cone, is placed in a furnace for two hours and slowly brought to a glow heat. The bottom is formed by a hard magnesia stone, E, provided with an exchangeable outlet. Each crucible will stand about twenty-five reactions of the thermit process. In welding, if a complete butt-weld of the head of the rail is required, rail-clamps are necessary, but not otherwise. The only other apparatus necessary is a mould box, having two parts, one for each side of the rail, which firmly enclose and fit the rail, and provided with channels for the thermit iron to run through. The whole outfit can be moved on a hand truck.

To weld a joint the rail ends are first cleaned of dirt and rust with a wire brush and slightly warmed; the mould is then

screwed to the rail and the rims touching the rail are smeared with clay. The crucible is placed on a tripod over the mould. The magnesia stone in the bottom of the crucible has an opening for the thermit when melted to run through. This is closed by a small

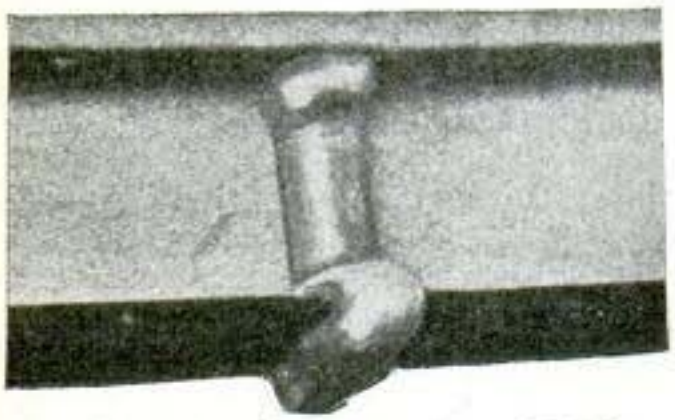


Fig. 3. Weld in Side of Rail

magnesia stone called a "thimble" (F, Fig. 1). A tapping pin is suspended by its scarfed end inside the thimble and the top of the thimble is closed, first with asbestos washers and then with a metal disk. This is rammed firmly in place with a hammer handle and then covered with magnesite sand. This prevents the thermit running out too soon. The apparatus then appears in arrangement as in Fig. 2.

All being in readiness, thermit in the proper quantity is poured into the crucible so that its surface is level, and a pinch of ignition powder is placed in the middle of it and lighted by applying a Bengal storm match. Chemical reaction thus started is completed in a half minute, and a pure liquid steel sinks to the bottom of the crucible, a distinct layer of aluminum slag covering its surface. The weight of the iron and this slag is the same, though the slag occupies three times as much cubic space. The weight of the iron is half that of the thermit powder. As soon as the reaction is completed, the crucible is tapped—that is, the tapping pin is sharply knocked upward and the thermit iron, at a temperature of 5,400 degrees Fahrenheit, so released, runs through the thimble into the mould, around the web and foot of the rail, melting them and forming one mass with them. The liquid slag which follows the iron is diverted to the top of the rail and brings it to a welding heat. The heat is equal throughout. Three-quarters of an hour are required for one man to weld one joint without the use of clamps, and each weld requires from fifteen to twenty pounds of thermit. As soon as the molten iron solidifies around the rail the moulds are broken off and the weld is complete. Fig. 3 shows the side of a welded rail and Fig. 4 the operation of welding in actual process.

The life of the track, it is said, depends upon the life of the joints and until recently joints were expensive, as the cheapest means of welding them required so much heavy apparatus—cupola, sand-blast machine, clamps, dogs, moulds—all of which must be moved as the work progressed.

Fig. 4. Welding Without Clamps

Dr. Hans Goldschmidt, of Essen, Germany, who first brought the science of aluminothermics to an applicable basis, says that for steam railroad practice it is safe to use

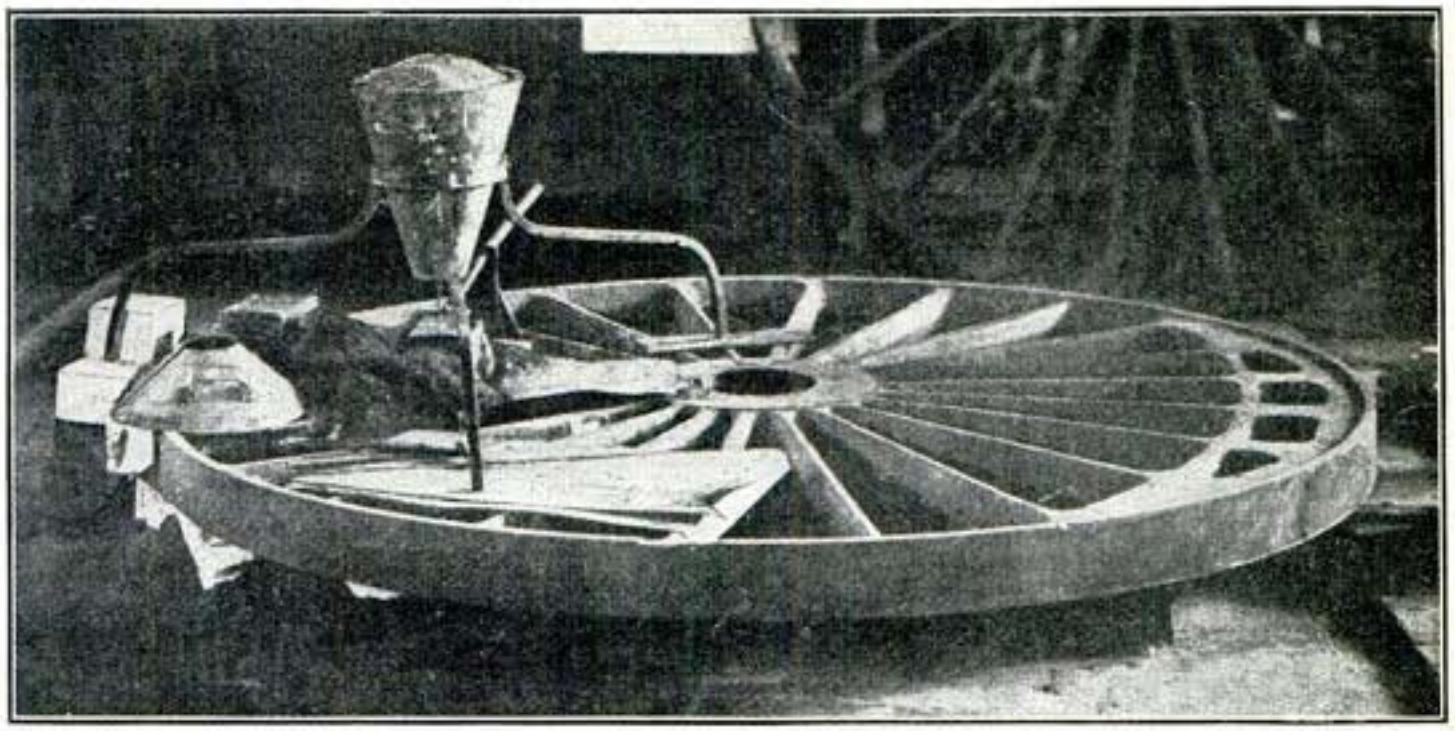


Fig. 6. Repairing Locomotive Driving-Wheel

300 feet of continuous rail with the proper expansion joints between each section; that for interurban lines 500 feet of continuous rails are practicable, and that in the paved area of a city, where the rails are practcally covered, the work can be carried on to much greater extent and the welded joint has an electrical conductivity greater than the rail itself.

Aside from welding rails, thermit has been used in an unprecedented manner for repair work. In connection with marine engineering this is especially true. The stern-post of the Hamburg-American liner "Sevilla," 9,000 tons (Fig. 5), had a fracture measuring 20 inches by 8 inches. Under ordinary conditions a new stern-post would have been necessary, the steamer being laid up in dry dock for several weeks while the new part was being fitted in. The part was welded with thermit, a crucible six feet high being used and 700 pounds of thermit. The reaction required but little more time than for welding a rail joint. In another instance a crankshaft on board a Rhine steamer was repaired. The steamer arrived in port at five p. m. of one day, and departed at ten next morning. In the meantime the 10-inch fracture in the crankshaft was repaired with 250 pounds of thermit in one reaction. Thermit was used also by the Austrian State Railway for repairing the spokes of a locomotive driving-wheel (Fig. 6). Each of these repairs is notable, in that had it been made in any other known way it would have required much time and expense, while the fact that it is possible to make a reliable repair in a broken crankshaft or other important part in mid-ocean is of prime importance, both to the commercial world and the traveling public.

Thermit is also used for welding third rails and for welding pipes while in position. Fig. 7 shows a pipe in vertical position ready for welding.

Thermit itself is in the form of a powder, is non-explosive and will not burn if

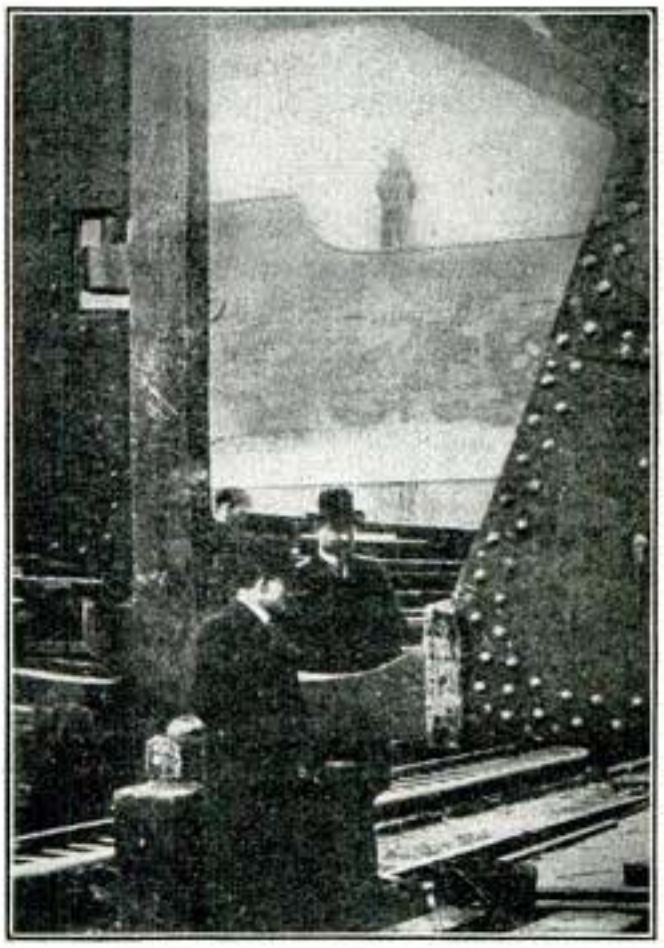


Fig. 5. Welding Stern Post of the "Sevilla"

thrown on fire. It is only ignited by means of the ignition powder provided with it. It only burns where it touches, but is so hot that it will burn a hole through an iron plate, the edges of the hole being perfectly clean. Workmen engaged in the use of ther-

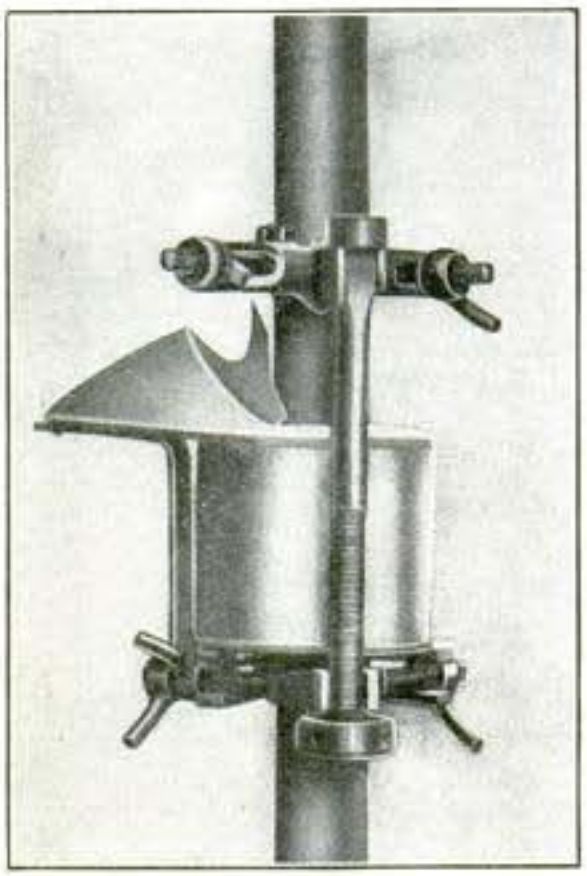


Fig. 7. Pipes Ready for Welding

mit are obliged to wear smoked glass goggles to protect their eyes against the intense light and heat.

Recently the Hartford Street Railway Company of Hartford, Conn., used the thermit process for welding 162 joints on a line where the joints were low in many places and the street along the track was paved with macadam. The line is laid with 6-inch girder rail in 30-foot lengths on standard wooden ties placed two feet center to center.

The process was new to the laborers and a little bungling resulted at first, but several points which could only be learned in the actual execution of the process were brought out. For instance, it was found that the more thoroughly heated the ends of the rails were (by means of a blowpipe) the smoother the flow of the metal, so that it did not spatter and burn the rail and that placing the crucible on the ball side of the rail as far away from the rail as possible, greatly reduced this danger also. Another important discovery is that after several pourings the asbestos washers cannot secure a jam fit because the magnesite lining at the bottom of the crucible wears away, and the result is that the contents are apt to escape too quickly. This was remedied by cleaning out the lining with an iron rod after each pour and tamping the asbestos washers down.

This company greatly reduced the expense of the process by substituting cast-iron moulds, made at the local foundry and costing $1.05 each, for the usual sheet-iron moulds and using ordinary foundry dry sand as filling instead of a mixture of half clay and half sand.

About every 1000 feet a slip joint—that is, a joint left unwelded with fishplates hot riveted to the rail and the ends of each plate bonded to the rail—was left to provide for expansion and contraction. Of the 162 joints welded, six were spoiled in the pouring, due mostly to the fact that the process was new.

Making a Pour at Hartford, Conn.

The work was carried on in very cold weather when the days were short and by a force of fourteen men and an engineer in charge. Twenty joints per day were welded. The total cost per joint under the conditions existing at Hartford was about $5.

The Undertype Engine

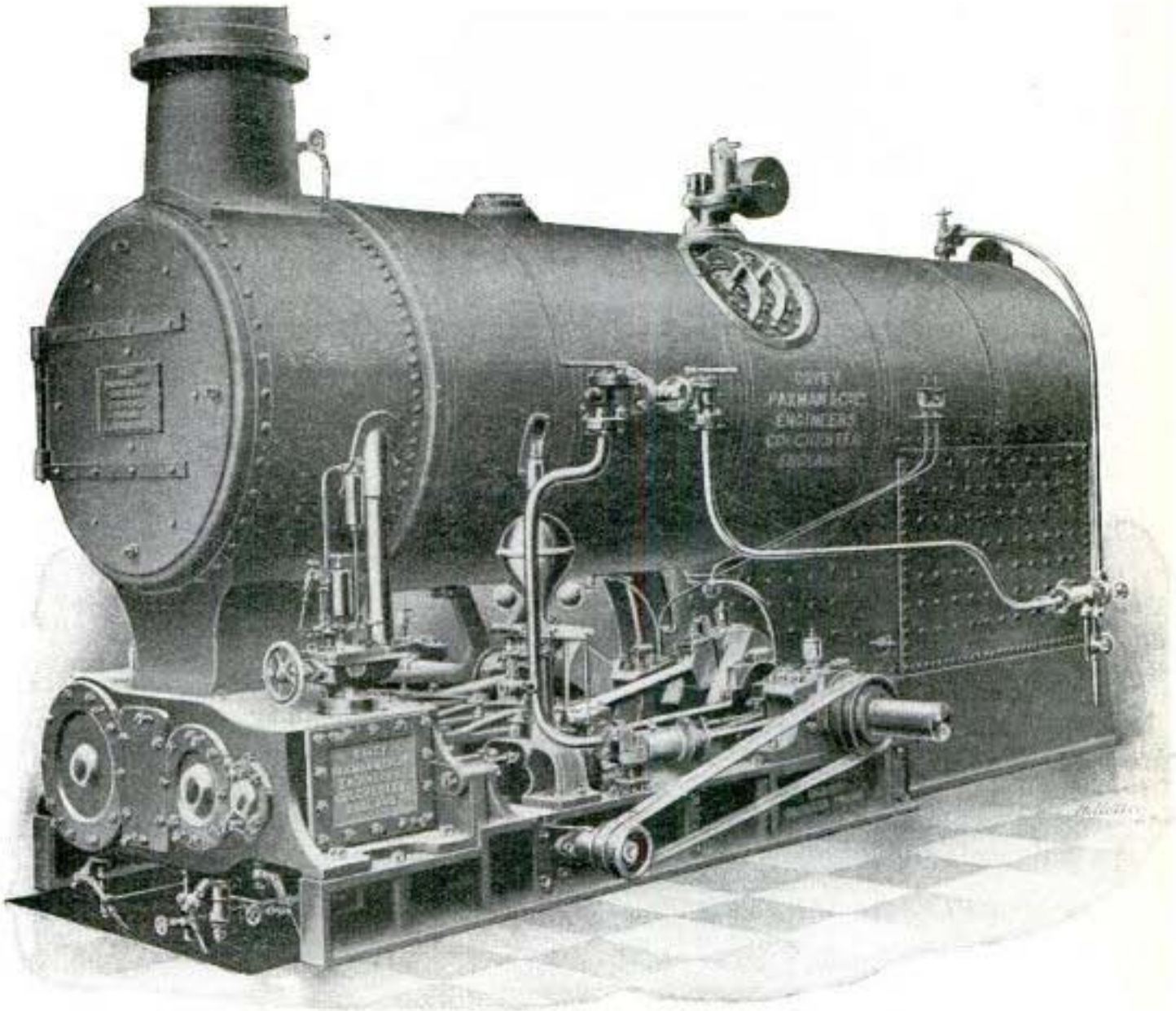
A Favorite English Type Made in Simple and Compound

The "Undertype" form of stationary engines are in considerable favor among English builders, and thousands of these machines are not only in use in that country, but the export demand for shipment to the colonies, particularly India and South Africa, is great.

One of the strong claims for this type is the saving in space, and the rigidity of the engine base frame, which is bolted securely to the boiler base, and thereby really made a part of it. One foundation serves for both engine and boiler. Both simple and compound types are built.

An idea of the power relative to weight may be had from two examples: A nominal 3 horsepower, with effective 8 horsepower has a cylinder diameter of 6½ inches and 10-inch stroke, making 165 revolutions per minute. This engine and boiler complete weighs 4,600 pounds. A nominal 12 horsepower, effective 34 horsepower, cylinder 12 inches, stroke 15 inches revolutions 125, weighs 12,100 pounds. Pressure 120 to 140 pounds. The "outfit" is complete, including engine, boiler, feed pump and stack.

The advantages claimed, says Page's Weekly, London—and with good reason—for the undertype engine, may be summarized as follows: Great saving of time and expense of fixing. Within a few hours of delivery, even a 200-horsepower engine of this class may be run into position, and the boiler filled up, little or no foundation beyond a well ballasted and level floor being required. The weight of the boiler and its contained



Complete Power Plant on One Frame

water are amply sufficient to secure the engine against movement, without being bolted down to the foundation, while the boiler itself is absolutely free from any strains due to the working of the engine.

The space occupied in proportion to the power developed, is considerably less than for any form of stationary engine with separate boiler. There are no exposed steam pipes, hence dry steam is secured—an important advantage. The use of a brick chimney is dispensed with, as the iron funnel supplied with the engine can be lengthened to suit any situation.

STEEL MAKING IN JAPAN.

Japan is rapidly developing its own iron mines, foundries and steel works. The government already operates imperial works where pig iron, steel billets and steel rails are turned out. The war has diverted the manufactured products from those of an industrial character to munitions of war, and less money has been available for extension of works than would otherwise have been the case.

Nevertheless the enterprising little nation is steadily improving in the quality of its iron products and increasing its facilities. The imperial works has during the past few months filled 866 orders for the army and navy and rolled 25,000 tons of steel rail for the Soul-Fusan, and 6,000 tons of light rail for other purposes. The ores came from Japanese mines. The smelter was opened in April, but on account of being used too early was out of service during May and June. Since July it has been in successful blast, and the output of late has been 149 tons of pig per day. A second smelter was opened in January of this year. The Bessemer plant started up in May.

The Japan Times, Tokyo, from which the foregoing is excerpted, says:

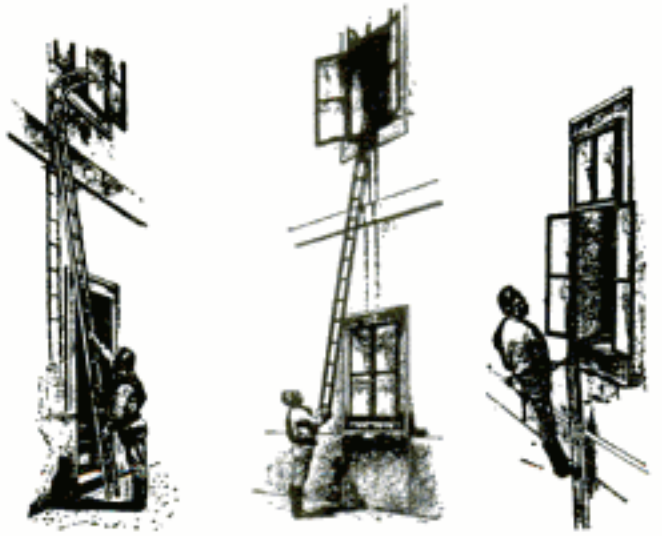
"Until recently ten foreigners had been employed, but in March last nine of them were released, leaving behind only one. At present the foundry was not able to manufacture the armor plates required by the navy, the metal for the barrels of rifles, and railway carriage wheels, owing to the absence of the necessary plants. But as a result of negotiations with the military and naval authorities, it was arranged that from next year the foundry, in co-operation with the Kure steel foundry, should manufacture all the steel necessary for the construction of warships and firearms, and such goods as axles and bolts for railway purposes."

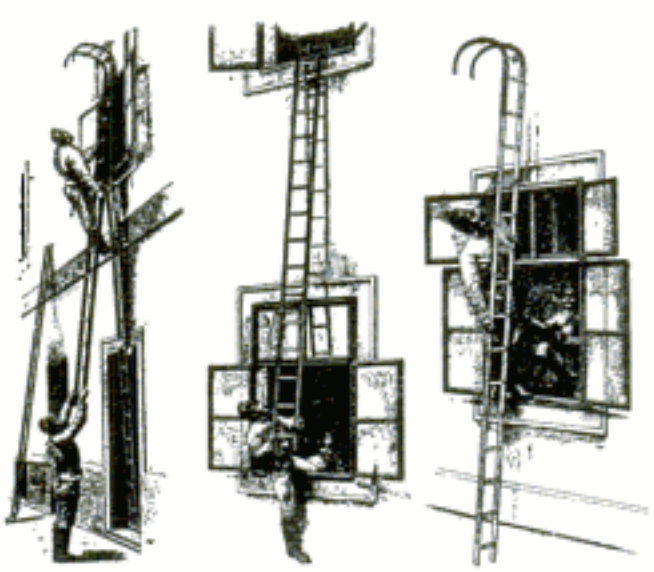
FIRE DEPARTMENT THAT NUMBERS MILLIONS

Every Inhabitant of Austria Subject to Fire Service on Call.

Austria boasts the largest fire department in the world, for every able-bodied citizen in town or rural district can be summoned by the mayor or chairman to perform service without pay. The law, however works no hardship, as the larger cities maintain a paid department and the smaller towns and villages have excellent, well-trained volunteer departments, which now number over 10,000, with 395,000 men.

Special pride is taken in the "hook-ladder"





"Hook-Ladder" Work

companies, whose work is similar to that of our own Pompier crews.

In every factory there are one or more volunteer companies, and throughout the country there is a remarkable uniformity of apparatus and methods.

The Vienna department is the one after which the nation patterns, and great pride is taken in the efficiency of even the smallest companies.

A general fund for the promotion of the

service and assistance of families of firemen injured or killed while on duty is secured through a tax of 2 per cent of all the income of the fire insurance companies.

Outside of its large cities probably no country in the world equals Austria in the perfection of its fire departments.

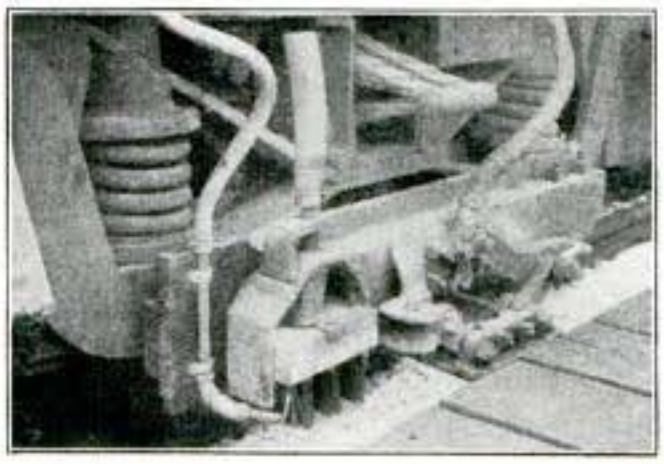
HUGE DIAMOND WEIGHS 3,023 CARATS, IS REPORT.

A huge diamond, weighing 3,023 carats and valued locally at $5,000,000, has been found in the Premier mine in the Transvaal, near Pretoria, is the report. Such a diamond would exceed in size any other ever found. M. Levy, of New York and a heavy owner of the Premier Company, was not impressed by the size of the stone. He said: "There is no demand today for huge gems which kings formerly coveted. It is doubtful if a stone as big as the Koh-i-Noor will ever again be cut in its entirety. This great diamond will be divided into as many smaller brilliants as may be done economically."

CLEANING THIRD RAIL WITH SOLUTION.

The removal of sleet and ice from the third rail of electric roads of that type continues to be a troublesome problem. The ice cutters and thawing methods are yet by no means perfect.

A solution of caustic chloride of calcium mixed with warm water in the proportion of 38 pounds of chemical to 7½ gallons of water,

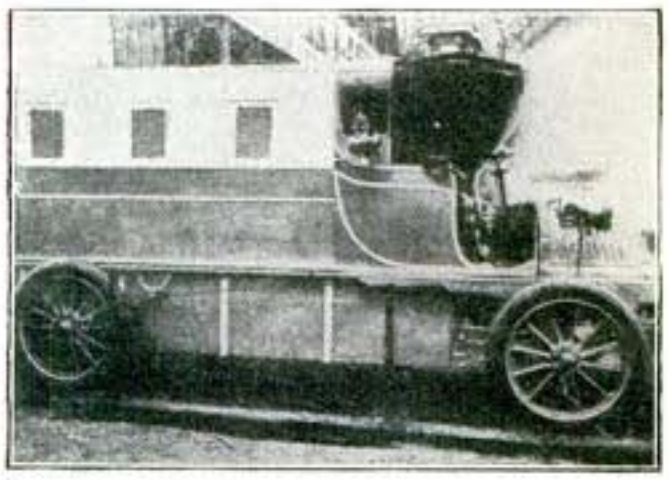


Location of Pipe.

is being used on one of the lines running out of Chicago. The mixture is carried in tanks on the car and fed onto the rail through a ¼-inch pipe. A gallon will cover a mile of rail. Very thin ice coating is entirely melted; heavier ice is softened so the sleet brushes clean it off. The Street Railway Journal says: "The corroding effect of calcium chloride on the copper is somewhat in dispute, but by so distributing the solution that it does not reach the bond, any danger is, of course, avoided."

HORSES RIDE IN AUTOS.

When horses ride in automobiles the tables may truly be said to have actually been turned. This very thing is actually being done in France. The vehicle is used for



Palace Horse-Auto

the transportation of valuable race horses when being taken from stable to depot, or to the race track. The entrance is at the rear, the door swinging down to make an incline. The interior is padded, and a partition can be inserted when occasion requires two passengers. A trap door gives the driver a chance to see that the horse is all right, and a feed box containing oats and another for hay make the trip a pleasant one.

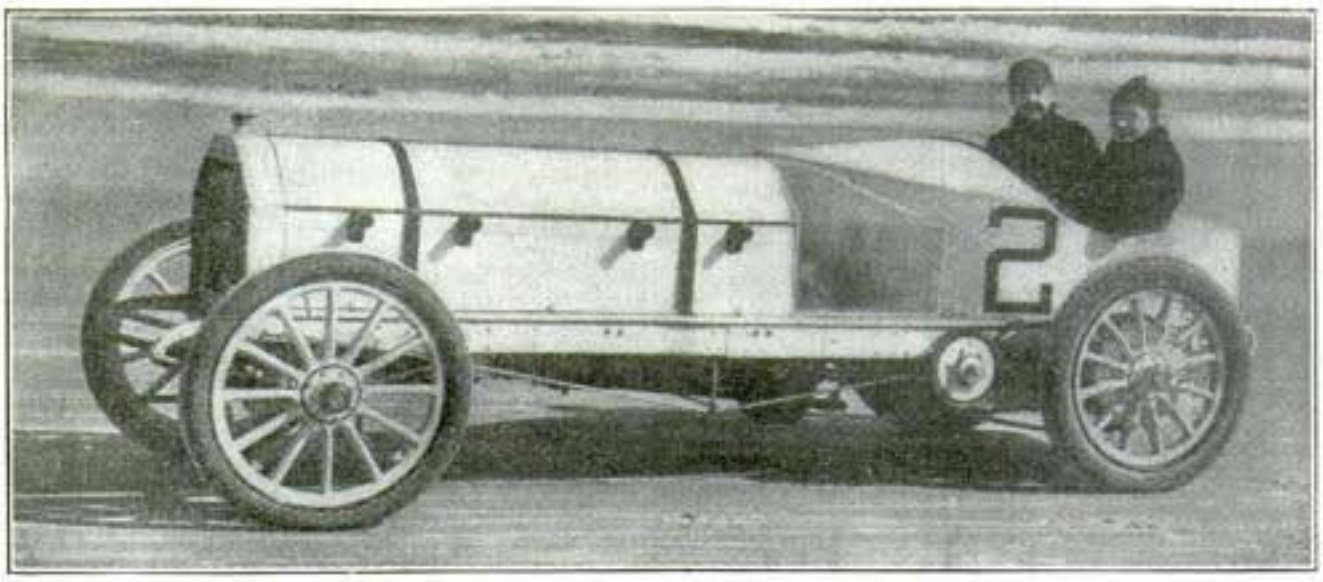
DISCOVERING PEARLS BY X-RAY.

In a series of experiments recently conducted in Ceylon, oysters were subjected to the X-ray to distinguish between those containing pearls and those containing none. It is said the experiments were very satisfactory in results.

GERMAN AUTOS UNDER $500.

German automobile manufacturers are putting on the home and English market a 4-cylinder motor car, holding four persons, at a retail price of $486.65. If for only two persons the cost is $73 less. The machines are said to be of excellent construction and guaranteed to a reasonable extent.

Automobile Covers a Mile in 34 1-5 Seconds



Machine That Broke All Records

A new world's record in automobiling was made on the Ormond-Daytona (Florida) beach course on January 25th, when a Boston automobilist, H. L. Bowdin, covered a mile in 34 1-5 seconds, or at the rate of 105 miles an hour.

The Mercedes car in which the run was made, known as the "Flying Dutchman II.," was equipped for the occasion with two 4-cylinder, 60-horsepower engines coupled tandem and the frame was lengthened by inserting two steel plates 20 inches long in the center, says the Automobile. The vibration of the powerful machine thus fitted up is so great that before each trip it must be gone over thoroughly and every bolt and nut made secure.

Other notable runs were made by Louis S. Ross driving a freakish looking 20-horsepower steam car, called the "Teakettle," which made a mile in 38 seconds, and by Arthur McDonald, driving a 90-horsepower Napier a mile in 34 2-5 seconds, a close approach to Bowdin's time.

The aim of automobile drivers now is said to be two miles a minute.

How to Telephone

Clear and Distinct Pronunciation Better Than A Powerful Voice-- Germs On the Mouthpiece.

There are various simple matters connected with the proper and improper use of the telephone, which, if generally understood and heeded, would make this very convenient instrument of communication, if not a thing of beauty and a joy forever, at least very much more satisfactory than many people now find it to be.

One thing appears to be tolerably certain —that everyone does not know the way to get the best results. A common mistake by those who use the telephone is that they do not place the lips close enough to the instrument. This, perhaps, is due in many cases to the fact that the old style instrument was a very different thing from the present one. In the former case it was necessary to keep the lips some inches distant from the box and to speak across the opening and not into it. "Get further away from the 'phone" was a familiar command when the old style instrument was in use, and many old subscribers can't get over that "long distance habit," as the telephone parlance has it, and the command to "talk louder" is often heard. Another reason for the failure to place the lips close to the transmitting mouthpiece is the fear of germs which, naturally enough, perhaps actuates many.

"Public telephone users who know that it is necessary to get close to the 'phone," said an observing operator to me the other day, "and who object to the moist or possibly unclean mouthpiece, often give the rubber piece a thorough wiping with a

handkerchief before talking. Some go even further and form an auxiliary mouthpiece by circling the rubber one with their hands, thus keeping the lips entirely away from it. You will hear people yelling at the top of their voices, though that class is diminishing every day, for it is becoming better understood that a moderately low tone with the lips close to the instrument secures the best results."

The operating part of the telephone mechanism, the diaphragm and the carbons, are in the disc back of the hard rubber mouthpiece, and it is absolutely impossible to get too close to it.

The voice of the speaker has much to do with the distinctness of the message. The worst telephone voice is the basso profundo; the man who in ordinary conversation can be heard like a megaphone above all others is usually asked to repeat. He could save himself a lot of trouble and his listener as much inconvenience if he would strike a higher key than is natural to him. As a rule women's voices are the best for ordinary telephone work, but not for long distance service. Then a strong, clear voice is required. Having a good telephone voice, however, is not the whole thing. The good speaker must enunciate distinctly. The one who jumbles his words in ordinary conversation can be understood by the person in front of him notwithstanding his imperfect manner of talking, because the listener sees the speaker, and the eye assists the ear, but on the 'phone it is quite different and "Can't understand you" is a frequent reply.

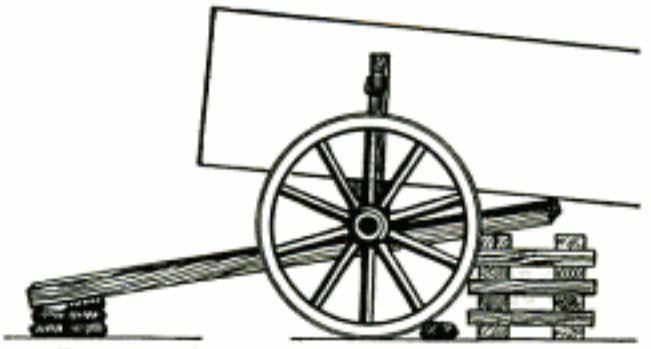
Defective enunciation has caused many to believe that certain sounds will not carry in the telephone, like "s" and "th," etc., but these sounds will carry all right and be understood if the person who utters them does so distinctly.

Said an expert: "If I were to lay down a rule for telephoning, I should say, keep the chin well up and speak with a large amount of air in the chest, articulate slowly and distinctly and use the lips; that is, throw the voice in the front part of the mouth—and be courteous." B.

ANOTHER METHOD OF LIFTING A LOADED WAGON.

A loaded wagon may be lifted easier by the method shown in the accompanying sketch, writes C. J. Case, of Troy, Pa., than by the method shown in our last issue and contributed by Lee R. Clarke, of Bozeman, Montana.

By the method here shown the crib is built under the wagon to full height of the axle bottom and the pole is then adjusted on the crib. Stone is then placed under the rim of the wheel and stone or wood under the other end of the pole, and the horses started up. If the wagon and



Lifting a Loaded Wagon

load weighs 8,000 lbs., of course, the actual weight lifted would be approximately one-fourth of 8,000 or 2,000 lbs., the weight on one wheel. Mr. Case says he frequently makes use of this means to oil the wagon with load on.

UNIQUE FLOATING LIGHTHOUSE.

A new type of floating signal or buoy has been adopted by the English Lighthouse Board, and the one illustrated herewith has

Light Burns 31 Days

been placed outside the Portsmouth harbor. It can be seen a long distance in day time, and at night burns a powerful oil lamp, which requires filling only once in 31 days.

ICE BOX WITHOUT ICE.

Miniature Refrigerating System for the Home.

It is now possible to keep your ice box at a temperature of from 35 to 40 degrees throughout the year, without ever hanging out the ice sign or having the drain pipe stop up on you. Not only that, but no im-

Cold Storage at Home

pure ice can endanger the family's health, and the supply of cold never gives out.

The above results are accomplished by a small portable refrigerating plant, either built into a box or applied to the one already in use, and which is a miniature of the great ice-making and cold storage plants manufacturing artificial ice or cooling great buildings.

The power to operate the cooling process may be either a small gasoline engine, or if the house is lighted with electricity a small electric motor is recommended. When started the machine runs continuously with very little attention. With the exception of filling the oil cups once or twice a week there is really nothing to do.

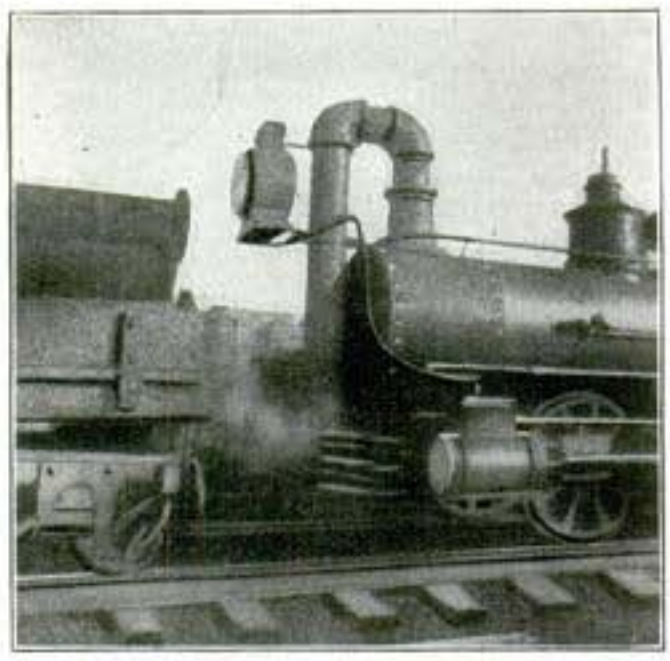
The cooling liquid is forced through the refrigerator in pipes, and while it cools does not produce the moisture and consequent dampness occasioned by the use of ice. About one-half horsepower is required for the work where it is desired to manufacture 20 pounds of ice per day for the table, and less power where the refrigerator is used as cold storage only. It is said the cost of operating the outfit is no more than is usually paid for ice during a season.

FUNERAL SERMON PREACHED BY TELEPHONE.

In Des Moines, Iowa, recently, the funeral services for a young girl who had died of diphtheria were conducted over the telephone, the minister preaching to two audiences, one at the house and one at the church. The girl had requested that the funeral sermon be preached at the house, and as friends could not attend because of the nature of the disease, this expedient was used. The minister preached at the church end of the line, with the aid of a megaphone.

LOCOMOTIVE THAT EXHAUSTS DOWNWARD.

A freak locomotive has been used in the construction of the New York subway. In order not to coat the white roof of the tunnel with a liberal layer of soot and dirt. This engine does not absorb its own smoke, but does the next best thing, and by means of the curious stack extension shown in the illustration exhausts underneath itself and toward the rear. Locomotive Engineering



The Freak Locomotive

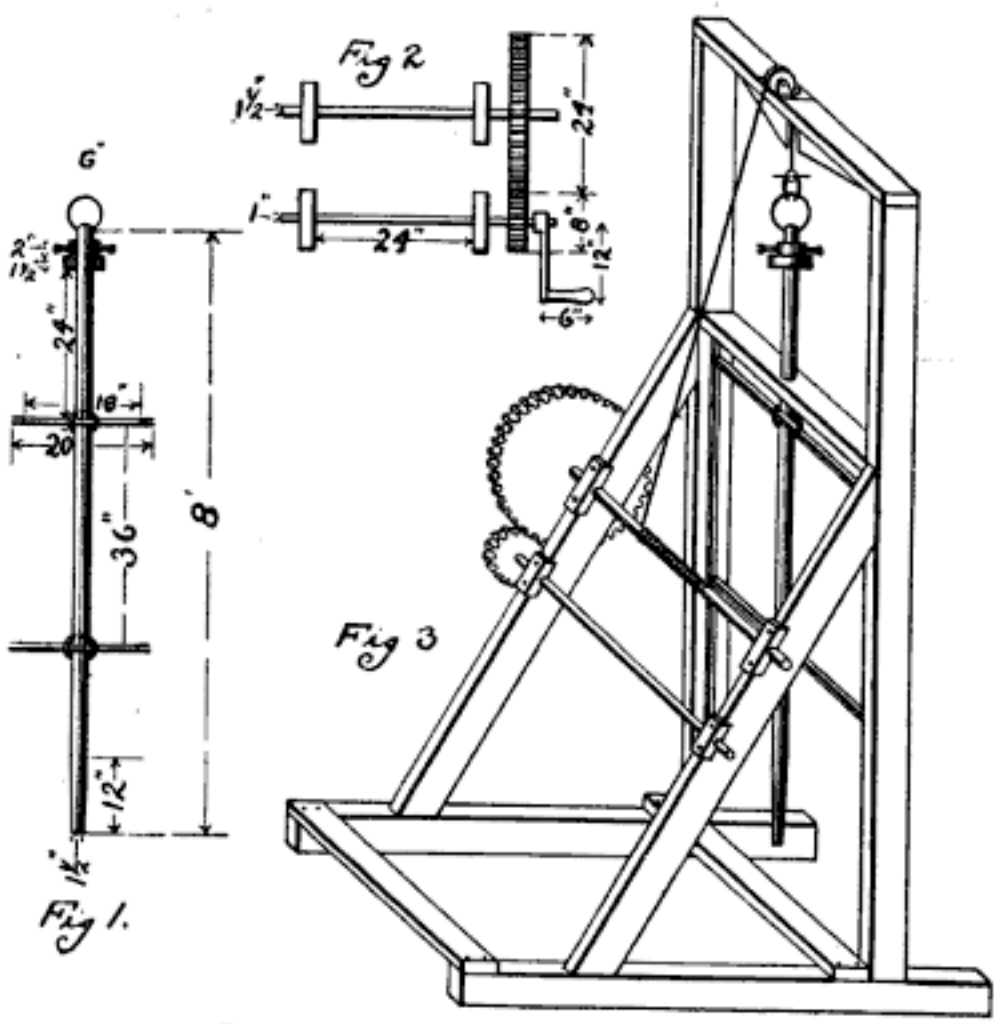
says: "When running forward this locomotive can do what few other locomotives can do—it can run over its own smoke."

The value of the electrical manufactures in this country during 1904 is estimated at $230,500,000. Of this amount dynamos and motors of all kinds amounted to $51,000,000.

ICE PUNCH FOR HEAVY ICE.

Users of water power, and not only the smaller ones, experience constant trouble with ice forming at the intake. Frequently it is no easy matter to get at the trouble, and a correspondent of the American Miller sends a sketch of a home-made machine which is guaranteed to break holes every time.

The drawings will give a very good idea of what is required. Old shafting, two inches or more in diameter and of any length, may be used, as required. Any old gear lying around the mill will do for the windlass. The only new part required will be a self-trip hook. The heavier the bar the better the punch.

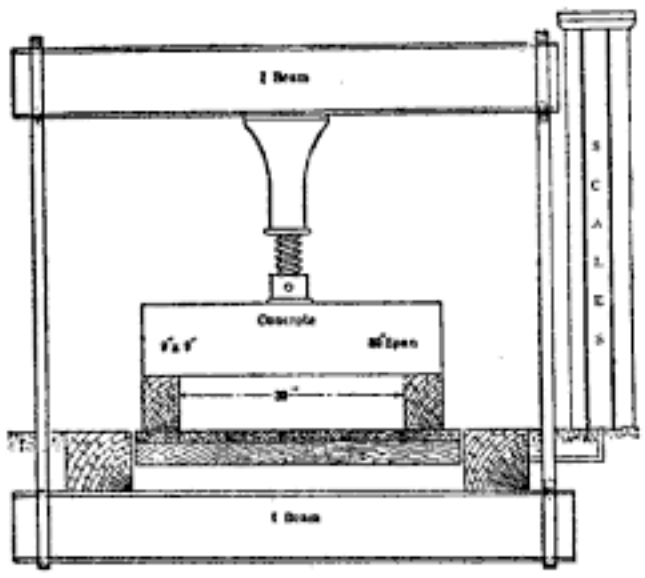


Ice Punch for Heavy Ice

TESTING CONCRETE BLOCKS.

Concrete blocks may be tested by means of a screw-jack and 5-ton platform scales in the manner shown in the sketch, says Henry W. Edwards of Grand Junction, Colo., and the test may be relied upon for all ordinary purposes.

The mixture to be tested should be rammed in a wooden box 9 in. square by 30 in. long, inside measurement, and allowed to stand for several days or weeks until set. It is then subjected to pressure in the apparatus shown, and the moment cracks appear on either of the visible sides of the block being tested, the pressure exerted by the screw-jack should be read off on the scale beam. This is not the ultimate crushing strength of the block—that can rarely be ascertained—but affords a comparative test of the tensile strength of the block, which is sufficient for ordinary purposes.



For Testing Concrete Blocks

DEAD BLACK COLORING FOR IRON.

Clean all grease and dirt from the metal to be blackened, and apply, either with a brush or by dipping the article in the liquid, the following compound: One part bismuth chloride; 2 parts mercury bichloride; 1 part copper chloride; 6 parts hydrochloric acid; 5 parts alcohol; 52 parts water, thoroughly mixed.

After applying the liquid place the metal in boiling water and let it remain therein at that temperature for a half-hour. Repeat this operation until the color is deep enough, and then fix the color by placing the article for a few minutes in a bath of boiling oil. After removing, heat until the oil is completely driven off. This method is recommended by the Blacksmith and Wheelwright.

TOOLS FOR CLEANING SEWERS.

Sewers frequently get choked up and cause no end of trouble, but how they are again put in service is something unknown to but few outside those who make a specialty of such work. The tools required are much more numerous than might be sup-

Operates Sewer Cleaning Tools

posed, and many special instruments have to be kept on hand for use when ordinary means fail. The Municipal Engineer illustrates some of the new "specials" which any expert sewer engineer will know how to make and use.

No. 1 is a root cutter, which will prove a valuable aid to the many engineers and sewer superintendents who have trouble with tree roots growing through defective pipe joints of open joints in small brick sewers.

No. 2 is a scraper for removing deposits of the softer materials which are still too dense or too sticky for flushing out.

No. 3 is a corkscrew which will penetrate any bundle of rags or paper and either pull it out or disintegrate it.

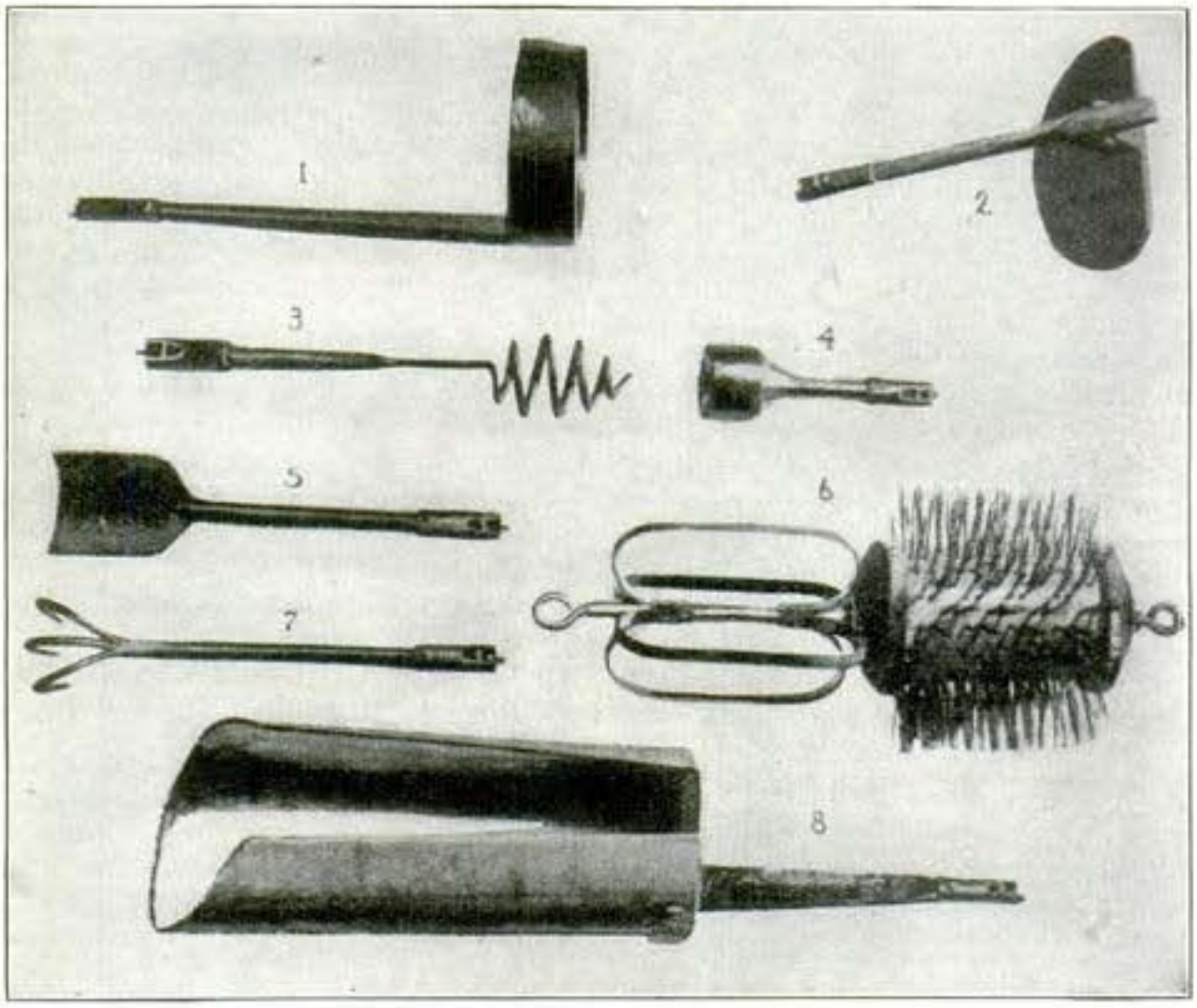
No. 4 is a plunger which is of special value in conduits to remove roughness when they have not been thoroughly cleaned before laying.

No. 5 is a chisel for use in breaking off hard cement left on unwiped joints, which projects and catches rags, papers, etc. It will also serve to cut off hard materials which have caught in open places in joints. A corset steel has been known to stop a pipe sewer by catching in such an opening in a joint and serving as a hook on which to hang a miscellaneous lot of obstructions that followed.

No. 6 is a brush which easily removes the accumulations of grease on the walls of sewers near hotels, boarding houses and certain manufacturing plants.

No. 7 is a claw which is sometimes needed in place of the scraper, No. 2, and may stir up such soft but adhesive materials as do not yield readily to the scraper, when they may be flushed or scraped out.

No. 8 is a scoop for removing deposits of sand from sewers. It sometimes happens,



Curious Special Tools Used in Cleaning Sewers

especially in new sewers, that a heavy rainfall will wash deposits of sand, gravel or clay into a long line of pipe, practically filling it. These deposits are hard to remove in pipe sewers and in the smaller brick sewers. The scoop can be operated for several hundred feet successfully, though slowly.

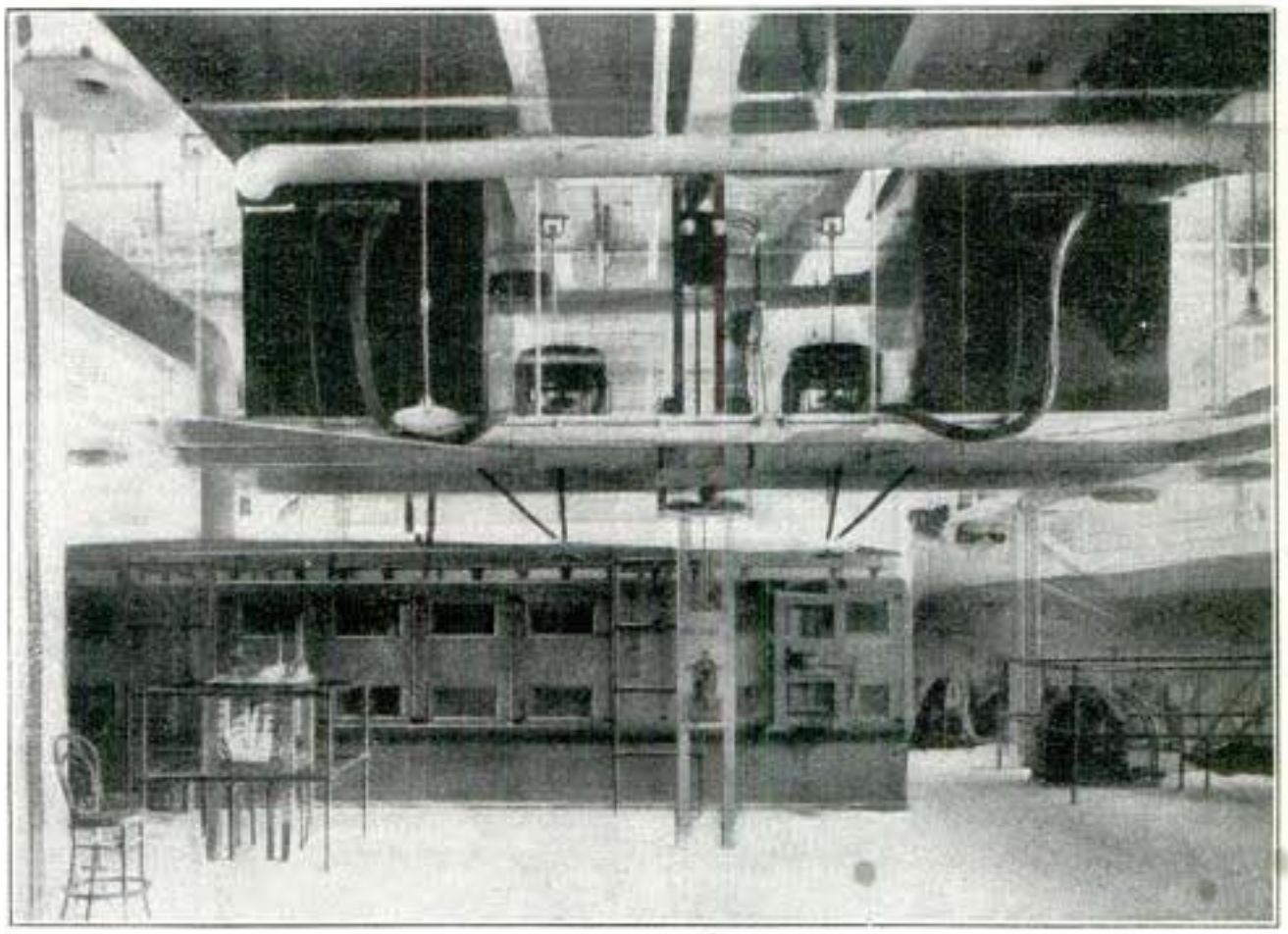
All these tools are fitted with sockets for use with the Felton coupling for sewer rods, which permits any desired manipulation of the tool on the end of a string of rod sections and at the same time makes easy the removal of the rod in sections at a manhole. The coupling is shown in the smaller of the accompanying cuts. It can be used also for pushing a lantern through a sewer for the discovery of leaks or surreptitious connections, whether in pipe or brick sewers.

An Electric Bakery

Niagara Falls has an electric bakery. Not only are the various machines for mixing the dough, rolling out and cutting into form, performed by machines operated by electric power, but an immense oven is heated by the electric current. No smell of smoke, no dust from ashes is known; when the baker wants to bake he simply touches a button and in a few moments the oven is in a glow.

Electric current is cheap in Niagara, for thousands of horsepower are being constantly generated at practically no operating expense. Water that formerly went plunging over the Falls is now turned from its old course and sent through giant turbines which turn the generators and produce the electricity which operates all the industries of the town, and many others in Buffalo, 20 miles away, including all the street cars of that city.

Broadly speaking, the cost to the ordinary consumer of electricity for cooking, ranges from eight cents to 15 cents per kilowatt-hour, says the Western Electrician. At Niagara Falls, however, the current is generated so cheaply that it is supplied in some instances as low as four cents. It is not improbable that there are other places in this country where waterpower is available to operate generating units at such a low cost that current can be used in the vicinity for domestic purposes as well as for operating machinery and illumination. Consequently we may first expect to see it used extensively in communities which are adjacent to such sources of power.

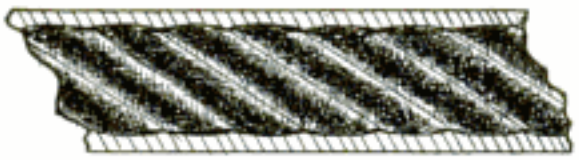


The Electric Bakery at Niagara

LIGNITE FOR LOCOMOTIVE FUEL.

A substitute for coal and wood has long been sought, especially in countries far from coal deposits.

Railroads in Colorado, Wyoming and the Southwest have experimented with lignite, a fuel half way between peat and coal in composition. Taking 100 parts, it is made up as follows: Carbon, 40 parts; easily evaporated matter, 32 parts; water, 20 parts; ash, 8 parts.



Spiral Corrugated Tube

An attempt to partly dry and press into small bricks some Wyoming lignite, resulted in making it cost $1.60 per ton, while coal mined in the same region costs $1.10 per ton.

Being light, lignite throws out many sparks when burned in locomotives. To prevent this, the old diamond stack with cone and netting in it is used, air openings in the grate are fine, and the ashpan is almost closed. This hinders the draft, so a small exhaust nozzle is used to produce it. Lessened locomotive power results from the small amount of heat in the lignite, inability to force the fire, and back pressure in the cylinder. A Wooten boiler having a large grate has yielded good results, but the best have been obtained with locomotives having spirally corrugated boiler tubes.

Instead of passing straight through the tubes and out, the sparks follow the spiral

Grate for Stoves

groove, and cool off. Advantages gained are: Freedom from spark danger, enlarged exhaust nozzle, ability to haul heavier loads and a higher speed.

With this outlook, more locomotives are being fitted with corrugated tubes, and in time lignite may become an economical railroad fuel.

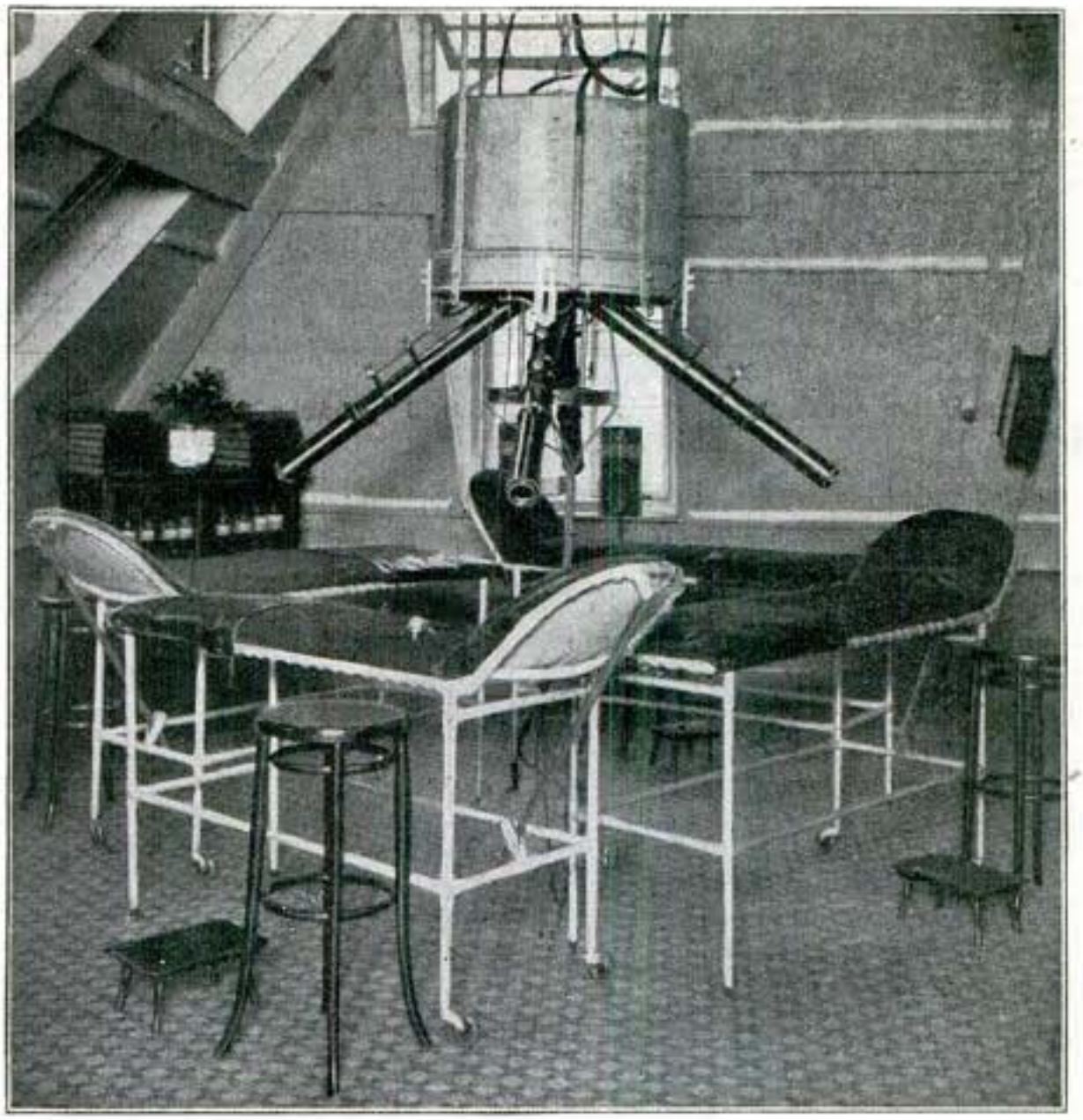
It is now possible to burn the lignite in stoves and house furnaces, but special grates have to be used. Lignite burns with a fine white ash, but requires a generous supply of air.

REMARKABLE CURES WITH ELECTRIC LIGHT.

Apparatus by Which Four Patients are Treated at the Same Time

No hospital in England or on the continent is now considered up-to-date without an equipment of the Finsen light apparatus for the treatment of lupus. Dr. Finsen, the inventor, died a few months ago, but the improvements he would have made, had he lived, are being effected by his enthusiastic followers.

The illustration from the Electrical Review, London, shows the latest type of the apparatus by which four patients may receive treatment at the same time. Suspended from a strong support is an arc lamp of extremely high candle-power, around which is suspended a heavy metal cylinder, serving to carry the telescopes and the necessary pipes and taps for the water-cooling of the telescopes and compressors, through which the rays pass before reaching the patient. The telescopes are constructed of brass barrel, with rock crystal lenses to concentrate the rays of the arc lamp. At the end of each telescope nearest the lamp a space is left between two of the lenses, which is filled with distilled water; around this a water jacket is fitted, to permit of the circulation of running water from the main supply, in order to keep it cool. The distilled water fulfills the double purpose of eliminating some of the heat rays, and of preventing the top lens from cracking owing to its exposure to the great heat from the arc lamp. At the other end of the telescope, for a space of about 12 in., between two more lenses, is a column of distilled water, which absorbs further heat rays. Around the four telescopes are arranged couches on which the patients lie whilst under treatment; the part to be treated is brought to the point of convergence of the rays through the telescope, and compressors consisting of rock crystal lenses, between which a stream of water is continually circulating, are pressed firmly on the skin, in order to render it anæmic, as the presence of red fluid would prevent the ultra-violet rays from properly penetrating. Here occurs the final



Electric Apparatus Treats Four Patients at the Same Time

exclusion of the heat rays, and the chemical rays alone reach the patient. By an ingenious arrangement, the fullest use is made of the light from the lamp, so that the current consumption is about 50 amperes only, as against 70 or 80, or even more, in the older types. The worst skin diseases are cured by this treatment.

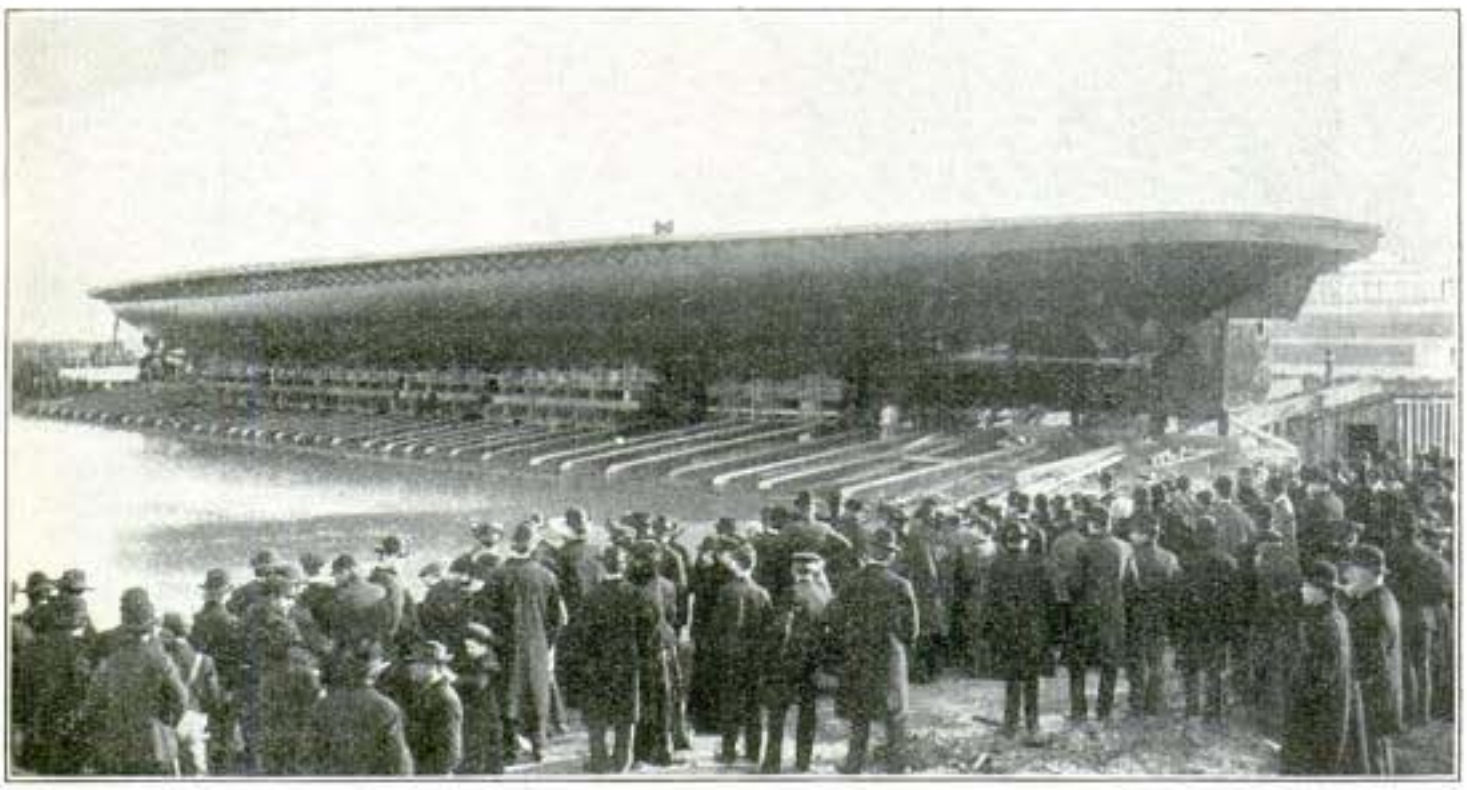
EXPERIMENTS PROVE THAT CONCRETE PRESERVES METALS FROM RUST.

That concrete preserves iron and steel and prevents it from rusting at all, even though it be partly rusted when imbedded in the concrete, is proven by two interesting experiments made by the Boston Transit Company during the construction of the East Boston tunnel.

Nine strips of sheet iron, 2 in. x 6 in., were cleaned till bright and free from rust and imbedded in a hollow cylinder of concrete, 14 in. by 20 in., outside dimensions, the walls being 3 in. thick. When hardened this cylinder was kept filled with water and placed in the tunnel. For a while water percolated through the concrete readily, but at the end of two months it had become watertight. At the end of two years the nine strips were removed and found to be as free from rust and as bright as when placed in the concrete cylinder.

In the other experiment a badly rusted square plate was cleaned by filing so that its general surfaces were bright, but rust remained in many small pits. This was imbedded in a block of concrete, placed in water for two days and then dried in air several days. This wetting and drying process was kept up for two years, when the plate was removed. Its condition was the same as when placed in the concrete except that the composition of the old rust had changed some so that its color was yellow instead of reddish brown as formerly.

Powerful Winter Car Ferries for Detroit River.



Launching the "Detroit of Detroit"

Powerful car ferries at Detroit are the connecting link between Canada and the United States for several important railways. The current in the Detroit river is very strong, and when great windrows of ice form exceptionally strong vessels are necessary to combat these forces.

The Michigan Central Railway system recently launched at Detroit a powerful new car ferry, christened "Detroit of Detroit," and especially fitted for the hard winter work on the river. The boat measures 308 feet in length on deck, is of 64-foot beam and 19½ feet deep. It has two propellers at each end, which are operated independently by means of compound engines, having cylinders 24 and 48 inches in diameter by 33 inches stroke. The steam plant consists of two double-ended boilers, 13 feet by 12 feet, and two single-ended boilers, 13 feet by 11½ feet. It is said these big ferries rarely fail to make the trip across the river.

HANDS ENJOY NOON-DAY PERFORMANCES.

Impromptu concerts and vaudeville performances is the means by which employes of a Milwaukee ice-machine building plant beguile their noon hour. The hands volunteer to perform, and it is rare that some outside influence draws one away. The bit of noon-day pleasure relaxes tired bodies, employers say, and leaves the men in a happy and contented frame of mind.

THE AUTOMOBILE SHOWS.

The recent annual automobile shows in New York and Chicago attracted thousands of visitors to inspect larger exhibits than ever before. The motor launch is steadily growing in popularity and is improving in speed and comfort. The 1905 types of autos show a decided improvement in standards of workmanship. Experts estimate the probable sales of automobiles during this year at about $30,000,000. There is a growing tendency to place the motor in an upright position in preference to the horizontal.

HUGE MAUSOLEUM PLANNED FOR CHICAGO.

A huge mausoleum with catacombs and crypts, patterned after that of Westminster Abbey, and costing $150,000, is the project of the Montrose Cemetery Association of Chicago. The plan is unique in this country, though there are few American cities where, because of the nature of the earth and the presence of water at a short depth, burial above ground is practiced exclusively. This is true of New Orleans. The crypts in the Chicago mausoleum, it is said, will be sold at $1,000 each. There will be in all 108 individual catacombs.

THE KERR COMPOUND STEAM TURBINE.

Drawings here given show the interior plans of a recently invented 10,000 horse-power steam turbine, which uses Belton buckets on the rim of a disk, against which steam from nozzles is directed.

In a recent article Power says: "The turbine is made up of a number of chambers, in each of which revolves one or more bucket-bearing disks, the number being determined by the amount of steam expansion for which the turbine is designed."

The buckets, Fig. 1, are double, elliptical in shape, and sharply curved at the bottom. The steam from the nozzles is divided at the point of connection of the two buckets, which later are riveted, B, or dove tailed, A, to the disk. A nozzle, D, is provided for each stage of steam expansion, and steam admission is hand regulated.

Six different expansions are arranged for in Figs. 2 and 3, the first two chambers having single disks, the next two, two disks, and the last two, three disks. Steam enters at E and passes to steam chest and through the nozzles to the buckets. Exhausting at F, it enters the next apartment, goes half round and again exhausts, so continuing to the final outlet. The disks are all of like diameters, hence the buckets all travel at the same speed. It is planned to have the speed one-half that of the steam jet flowing through the nozzle from one stage to the next. The areas of the jets and buckets are progressively increased to allow the entering steam to pass with this velocity. If this condition is maintained, the steam will be discharged from each set of buckets practically at rest, having delivered all its energy to the disk, and by dividing the turbine into a sufficient number of stages this velocity can be kept within required limits.

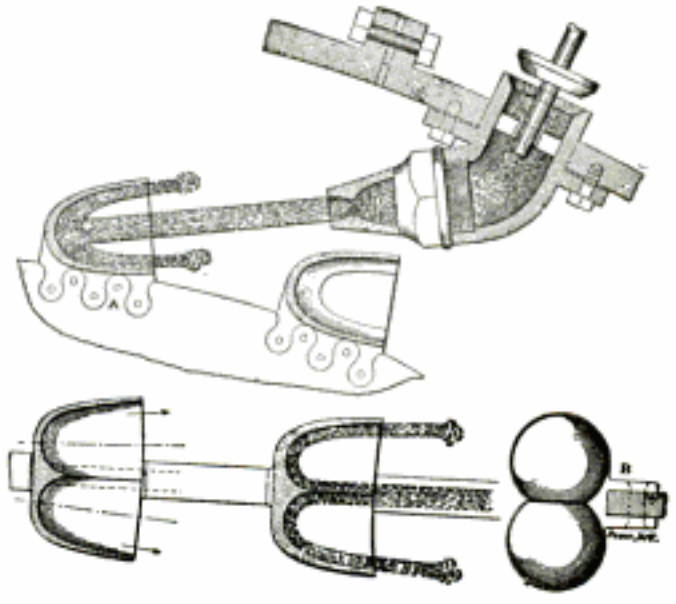


Fig. 1. The Kerr Compound Steam Turbine Buckets

In the turbine illustrated the bucket disks are 8 feet in diameter, the inlet pipe 8 inches and the exhaust 36 inches in diameter, designed to expand steam of 200 pounds pressure to an absolute pressure of two pounds.

When a good razor paste is needed use the grit from a fine grindstone.

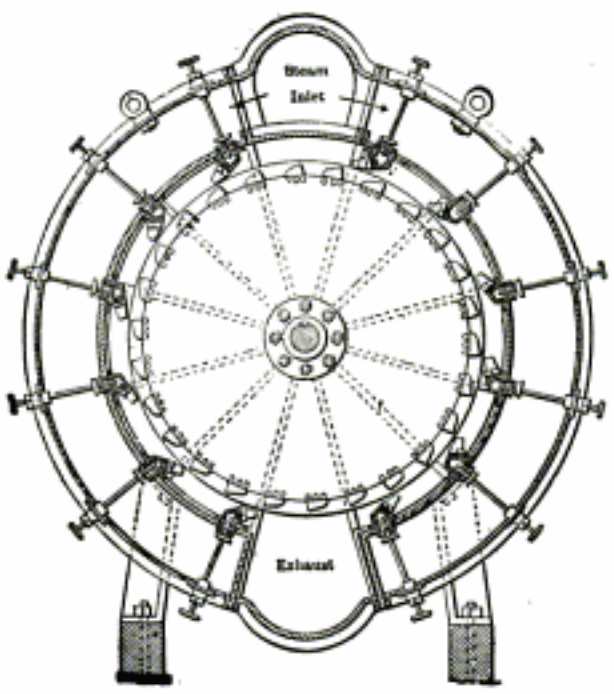


Fig. 2.

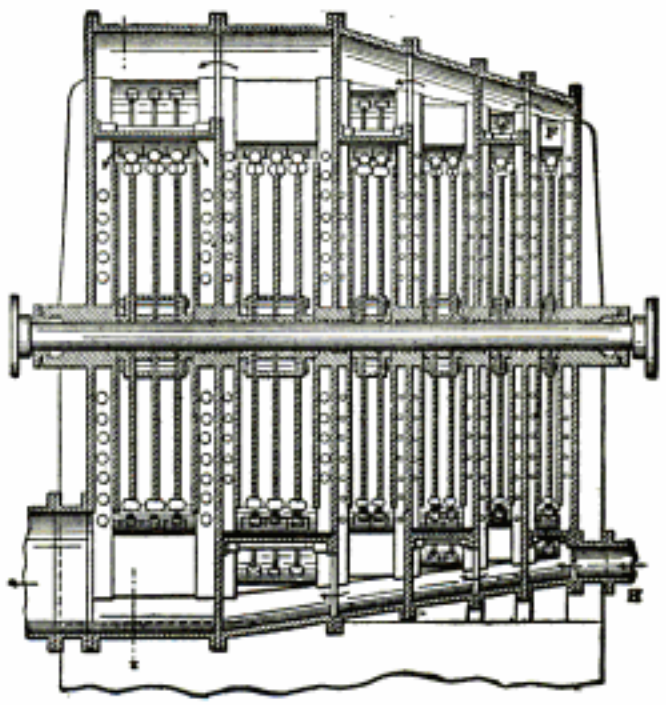


Fig. 3.

IGNITION FOR MULTIPLE CYLINDER ENGINES.

The jump-spark system seems to have proved itself satisfactory to automobile builders, and a large number of the 1905 machines will use it.

The magnetic spark plug has worked well on slow speed engines, but it is unsatisfactory on automobile and launch motors with

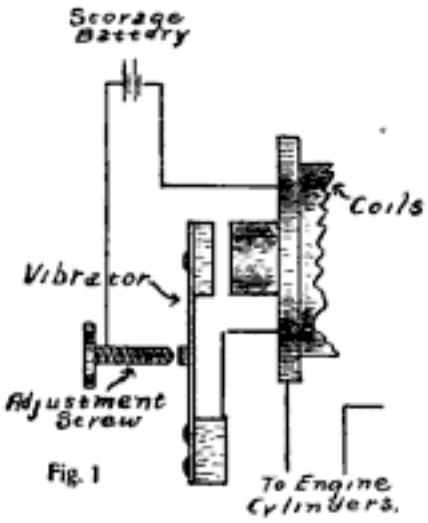


Fig. 1

varying speed. A perfect make and break timing device is needed to make it a success on these latter.

A well-known American automobile builder will use the alternating magneto this year. This gives a timed jump-spark, but the trouble here lies in the fact that its magnets sometimes lose their magnetism and have to be remagnetized at the factory.

In the Automobile Review, R. L. Hubler says that the ideal ignition outfit for multiple cylinder engines should consist of a storage battery for furnishing current to the coil, and a dynamo to recharge this battery.

A storage battery gives a large, hot spark, but used alone, it must be recharged, whether convenient or not.

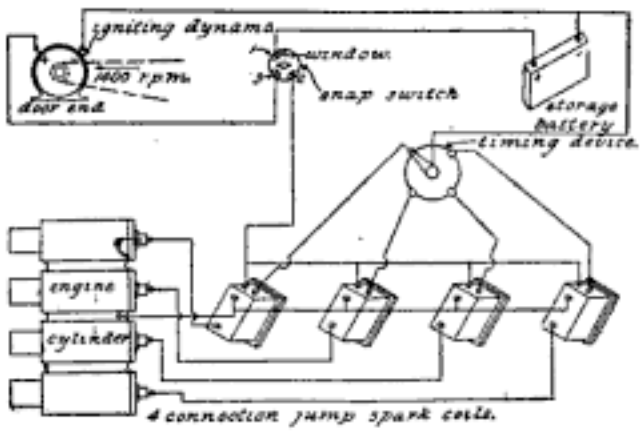


Fig. 2

Using the storage battery only to start the engine would do, if the voltage of the battery were always as high as that of the

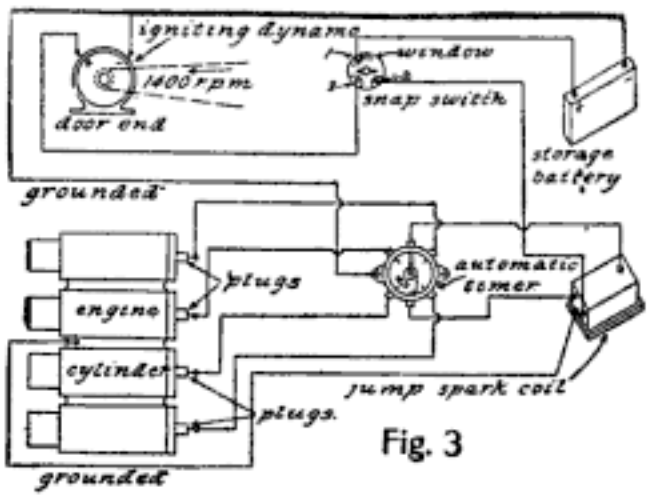


Fig. 3

dynamo. As, after use, it might not be, switching from one source of current to the other would cause trouble with the vibrators (Fig. 1). The best way seems to be to use the battery current for ignition, leaving the dynamo to charge the battery when necessary.

Fig. 2 shows the wiring plan for a four-cylinder engine using four single coils. Today, short circuit troubles may be banished by using well insulated timing devices.

Fig. 3 shows wiring for a single coil on a four-cylinder engine. Apple's timing device, here used, distributes the current to the cylinders at the same time that it times the current from the battery. The cost is less and only one vibrator requires attention.

The complete ignition outfit of this type, consisting of the ignition dynamo, six-volt storage battery, coil, timing device, switch and plugs costs about $60.00. The user need buy no primary batteries, he has a simple apparatus, and two sources from which to get a spark.

CONCRETE FOR PAVING STREETS.

Concrete street pavements are being tested in Bellefontaine, Ohio, and other cities, so far with satisfactory results. Asphalt, which is generally regarded as the ideal paving is very expensive, soon wears out, and has a tendency to get slippery when wet.

Concrete is both artistic and economical. For a street pavement smooth cement surfaces would not afford a good footing but the surfaces could be moulded with shallow corrugations and the result be a pavement adapted to all kinds of vehicles. Concrete is so easy to repair and so strong even if undermined that the idea seems a good one, but of course, like every other pavement ever laid, can only be properly tested by time and use.

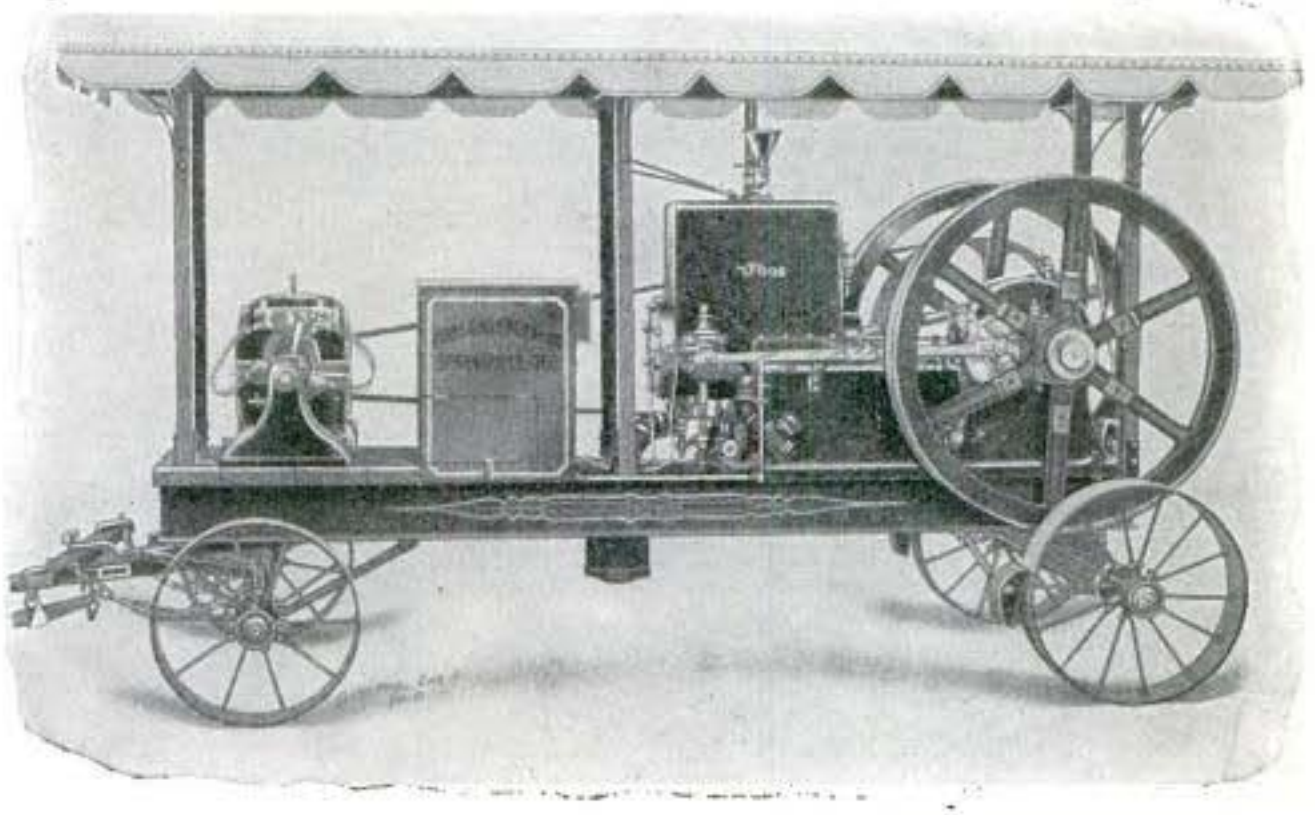
HOW WOODWORK IS SET ON FIRE BY STEAM.

Mysterious fires occur occasionally, when it seems impossible to trace their origin. A large and elegant dwelling house in New York was not long since burned, and it was found that the fire was caused by a steam drum in contact with wood, with which it was encased. The manner in which a heat of less than scorching intensity sets fire to woodwork is not generally known. The conditions to produce this are, first, a degree of heat not less than 212 degrees; second, the presence of wood in close proximity to the iron steam pipes; third, the existence of scale or rust on the iron; fourth, varying temperature. The heat drives the oxygen from the iron rust, which then becomes what is known as reduced iron, a finely divided metallic powder of the natural color of iron. The heat necessary to ignite the wood, which is in a tinder-like condition, from its proximity to the hot pipe, is generated in the rapid oxidation of the iron. It absorbs oxygen so rapidly under certain amospheric conditions of humidity and temperature as to glow for a few seconds, long enough to set the adjoining wood on fire. The greatest caution should be exercised in installing heating systems to allow ample space between steam heating pipes and adjacent woodwork.

PORTABLE ELECTRIC POWER PLANTS.

A portable electric power plant with all its parts constructed to withstand the strain of hauling over rough roads from point to point as required, is a new and interesting development in this line. The plant is mounted on a steel truck, which is fitted with a top and curtains for protection against the elements and the whole apparatus can be drawn by two horses.

The outfit is efficiently used for operating electric tools, temporary electric lighting and like purposes. It consists of a 22-horsepower gasoline engine having no water pipes or connections which are liable to freeze, but having a special design of cylinder and water jackets, which carry enough water to cool the cylinder. The water has a free passage to the air and maintains an even temperature. Water must be added to make up for loss by evaporation, but no other attention is required in this respect. A water glass in the cylinder gauges the height of the water. The gasoline engine is belted to a dynamo of the same capacity.



Courtesy of the Foos Gas Engine Company

Portable Electric Power Plant

An electric railway to carry passengers up Mt. Blanc is the project of a Paris company. The line will end at the Aiguilles du Gouter, 14,430 ft. above sea level. This will be the greatest enterprise of its kind. It is said there will be but one tunnel.

This Bridge Has a Single-Leaf Simple Truss Span 160 Feet Long

Courtesy Scherzer Rolling Lift Bridge Co.

REMARKABLE ROLLING LIFT BRIDGE AT CLEVELAND.

Longest Simple Truss Span Sherzer Bridge Ever Built.

A new railroad bridge at Cleveland, Ohio, has a movable span 160 feet in length from center to center of bearings. The bridge is a double-track rolling lift structure and is built at an angle of 60 degrees 30 minutes 30 seconds in order to meet the requirements of the city of Cleveland and the War Department calling for a clear channel for navigation 120 feet wide.

The bridge is operated by two 50-horsepower continuous current motors and all operating machinery and motors are placed upon the movable span. The pinion at the center of the rolling segment, engages with the rack which is fixed and supported alongside the girder; this is said to simplify both machinery and operation and shorten the total length of bridge required. Despite the strong operating power provided, the bridge, in ordinary weather, is operated by less than 20 horsepower.

When closed the tracks interlock with the mechanism for locking the bridge so that it cannot be operated before the proper signals are given. Derailing tracks also prevent the passage of trains.

The structure is designed to carry two 177½-ton locomotives drawing a uniform load of 5,000 pounds per lineal foot on each track: the rails weigh 100 pounds per yard. The bridge is supported by Portland cement concrete piers resting on piles.

STERLING SILVER FURNITURE FOR AN ORIENTAL PALACE.

A suite of sterling silver furniture, comprising two ordinary easy chairs, two couches, four tables, a dressing table and a large cabinet, all modeled and chased in the Louis period style, has recently been made in London for the palace of an Oriental magnate, says the Keystone.

The pieces are upholstered in dark blue plush at present, but a rich silk brocade is to replace this. Several of the maker's best artists are now engaged in decorating a sterling silver bedstead, also. Four emblematical figures, each 2 feet 9 inches high will surmount the pedestal at each corner, and the panels are decorated with studies after the pictures "Somnus" and "Dancing Nymphs," by Albert Moore, R. A.

CONCRETE NOT PROOF AGAINST FUNGOID GROWTH.

Rats cannot gnaw through concrete, but fungus can grow through it. There was a remarkable instance of this found in Portsmouth, England, recently, where a fungoid

Fungus Growing Through Concrete

growth forced its way through three inches of concrete and two inches of asphalt, thus showing the great leverage of growing plants. The fungus was a mass 30 inches in circumference and grew to a height of 9 inches.

LARGEST DAM IN THE WORLD FINISHED.

The huge Cornell dam, with the exception of the Egyptian pyramids, the largest piece of masonry in the world, is at last completed. On Jan. 31 the flood gates were shut down for the first time. It will take two years for the reservoir to fill and it will form a lake 16 miles long, and the sites of several towns which were abandoned for it will be flooded. The dam has been under construction for 10 years and cost $9,000,000.

The submarine boat "Simon Lake X," in submerging tests made at Newport News a few days ago, broke the record formerly held by the French type submarine. The "Simon Lake X" was submerged 38 ft. and returned to the surface in just 30 seconds.

How to Make Emery Wheels

We want first to observe the different forms of grinding by means of the emery wheel, and construct our wheel accordingly. There are flat surface grinding in which the emery wheel is utilized for general grinding, cylindrical grinding in which the wheel and the work are rotated, and common tool grinding in which the processes

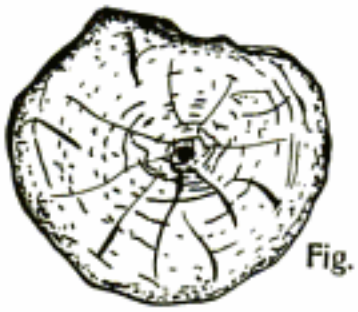


Fig. 1

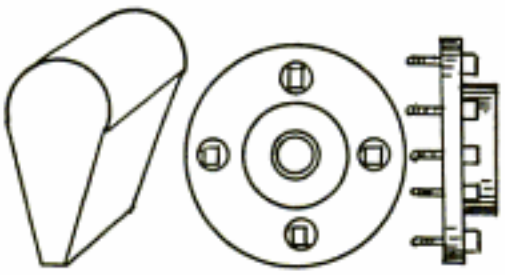


Fig. 2 Fig. 3 Fig. 4

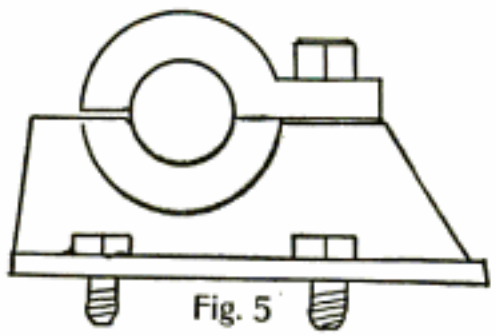


Fig. 5

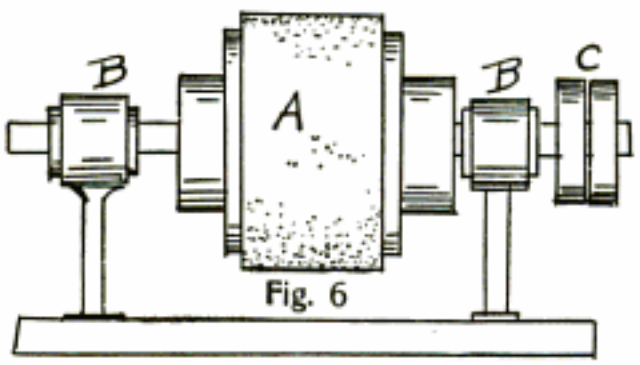


Fig. 6

of tool sharpening form the main work. It might be well to refer also to the smoothing of surfaces with grinding wheels of emery, as the emery wheel of modern times is used for this duty quite frequently. In fact, the modern emery wheel has supplanted many other forms of tools and devices in shops and mills for grinding purposes. For this reason, it is a good idea for the technically inclined man to be familiar with the construction of the modern emery wheel.

First of all, we want the substantial emery wheel, with the powerful frame, the necessary attachments, and the correct composition. Such wheels are usually built up in the shop. There are several designs of the wheels possible to make and the attached illustrations are suggestions in this line. The composition of the body of the wheel may be wood, built up leather disks, or hard rubber, etc. The ingredients employed are glue, litharge, silicate of soda, and celluloid.

Fig. 1 shows the common piece of block, hardwood selected because it is well seasoned, free from knots and flaws, exceptionally tough in fiber and possesses other features that a reliable wood should have for an emery wheel base. The tougher the fiber, the better. The wheel may be turned down in circular form by means of the lathe and the disk used entire. In some places, however, the disk is made up by using separate V-shaped pieces, one of which is shown in Fig. 2. This piece is in readiness for insertion in the general body forming the cylinder. Then when all of the pieces are joined on the common metal hub with its flanges, the flange bolts are put through and tightened and we have a body work as in Fig. 3. Fig. 4 shows the plan of the flange. There is one of these flanges for either side of the wood. This holds the separate wood pieces in line.

Capped Journals.

A good type of iron-capped journal to sustain the shaft of the wheel, so that the wheel may be put in position for covering with the emery is shown in Fig 5. These journals can be purchased from almost any machine builder. The arrangement of the journals on the stand of the emery wheel is shown in Fig. 6, the box bearings being marked B, B. The shaft is provided with a tight and a loose wheel at C and by the use of these wheels with proper belt and shifter, the emery wheel can be started and stopped at will.

The emery wheel itself is marked A. Some of the wheels are first wound with textile fabric, such as strong duck, or similar cloth, about the cylinder, previous to applying the emery. The process of winding a wheel with texture, paper, sheet rubber, or leather is shown in Fig. 7. Usually

the base of paper, cloth, rubber or leather is secured with cords wound on, and the cord-winding operation is conducted on practically the same lines of operation as the paper or cloth winding. The emery wheel proper is placed in its frame and set up as at D Fig. 7. Then a crank E is set-screwed or keyed to the emery wheel shaft and this crank is used to turn the wheel. Sometimes a pulley is fixed to the shaft instead of the crank and the wheel is operated with a belt. With the power belt, more strain can be secured on the winding parts and a better and tighter operation result. The line of the goods in process of winding from the rolls to the wheel is indicated at F, and at G. These rolls are properly "braked" so as to make the winding firm.

Ready For The Emery.

The next process involves the application of the emery. Fig. 8 is a cross sectional cut through the center of the wheel. The shaft is marked H and the wooden V-shaped pieces, which are held in position in disk form by the flanges are indicated J. The wound cords on the surface are marked K; the flanges, I, I; the stands for the bearings of the shaft, L, and the crank for turning the affair is at M. The glutinous matter on the rope surface for the purpose of retaining the emery may now be applied. There are men who manage to do good work with the common brush and common glue pot, while others need specially made devices. The common glue brush, however, can be made to do the work satisfactorily. Riggings of tanks and burners are sometimes arranged, at considerable cost, to deposit glue liquids over the turning cylinder below; this being followed by the application of the chosen emery. A good-sized glue pot with the usual means of keeping the contents at an even temperature is just as good. Apply the glue with a brush like the one shown in Fig. 10 and rub the surfaces with a scrub-brush similar to the one in Fig 11.

For a distribution of the emery, a regular emery distributer may be purchased or a device like that in Fig. 9 may be made. This is simply a tank made of sheet metal, with parting walls between each of the gauges. The gauges are simply pieces of flat metal inside the reservoirs which may be tilted to the right or left by means of the wheels at N. By tilting one way or the other, the channels controlling the flow of emery are opened or closed and the flow of emery governed thereby. The flow of the emery is downward by gravitation through the nozzles P, to the revolving emery wheel surface a little below. Thus the scattering of the emery is accomplished. In regard to the grade of emery to select, the coarse No. 36, if for a rasp-like face, or the fine No. 120 emery, if for polishing and buffing purposes, will be required. No. 90 to No. 120 include the sizes most in demand for ordinary work. The numbers indicate the size of the grains of emery. No. 120 means

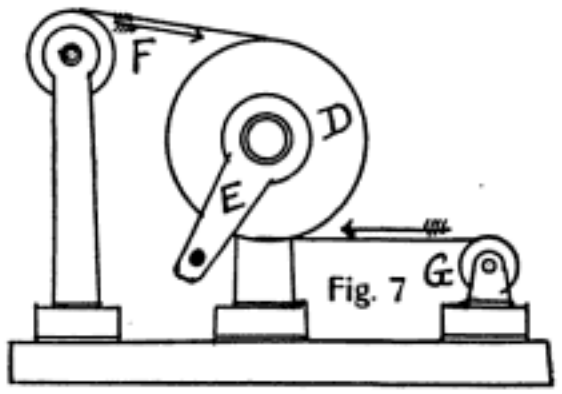


Fig. 7

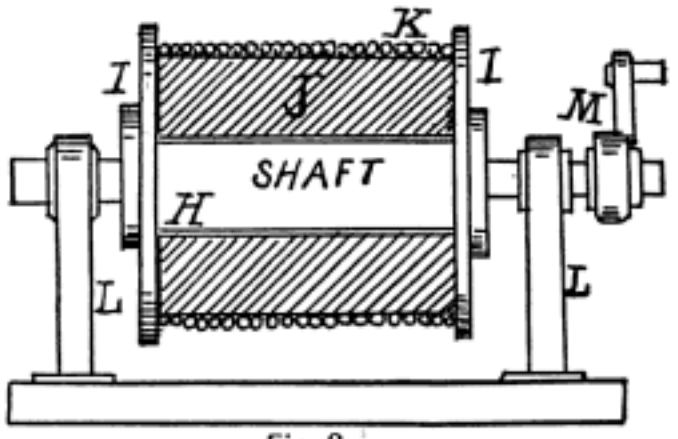


Fig. 8

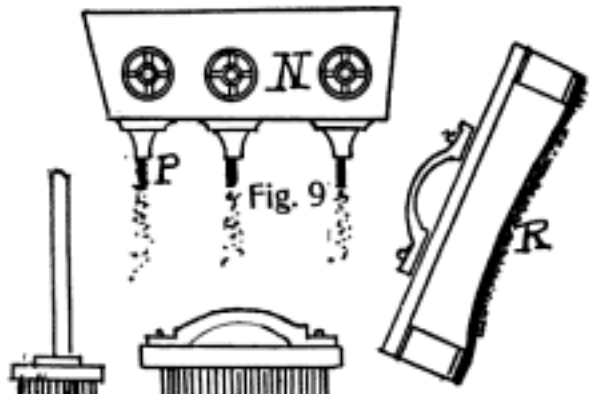


Fig. 9

Fig. 10

Fig. 11

Fig. 12

an emery ground so fine it will pass through a mesh or sieve having 120 wires to the square inch. The No. 36 is the size passing through a mesh formed by using 36 wires to the square inch. The dead smooth sizes can be made up for practical use as well as the exceedingly coarse numbers. But these extremes are not much used. As a rule the common bastard, second cut, smooth cut, etc., are in common use. It is not often that the dead smooth wheel can be used,

while one of the medium sizes is very frequently needed.

Evening Off.

One of the final operations is the evening off of the surfaces. This has been done very successfully with processes that involve the placing of the wheel in a lathe and turning it down with steel cutting tools. But this process requires an expert and the best of tools and contrivances. The ordinary machinist simply builds an evener similar to the one shown in Fig. 12. First construct a wooden frame about 2 ft. long and 10 in. wide. This is made of a piece of hardwood board, with two end pieces the same width as the board screwed on as shown. These end pieces form the support for the emery cloth, so called. This emery cloth is usually a leather base, on which the emery of desired fineness is scattered after the proper glue surfacing is made. This part is marked R. After a little use the constant pressure of the wheel on the leather causes the leather to assume the partly oval condition shown. There should be a wooden handle secured to the board top as shown, so that the user may have a good grip on the device. The device is held in one hand against the revolving surface of the emery wheel and the necessary fineness of finish is ground on in a little while. All lumps and uneven places are ground off quite speedily. The emery wheel is then ready for use.

METAL COSTUME PROTECTS AGAINST ELECTRIC SHOCK.

A German inventor has produced a metal dress which is said to protect the human body against powerful electric currents. Hitherto rubber gloves have been the means of protection employed by electricians and the number of deaths resulting from accidental contact has been great.

The new electricity resisting dress is designed on the principle that metal is a better conductor than the human body. It is made of woven metal, or fine wire gauze, and is so supple that the movements of the body are unrestricted. The garment is worn either underneath or over the clothing. In testing the device the inventor, clothed in the metal garb, received a shock of 150,000 volts, the current passing through the metal dress and not affecting its wearer. Frequently a 500-volt current will kill a human being. Electricians of several large German works have adopted the costume; but the average American electrician will give one look at it and go on taking chances.

Woven Metal Costume for Electricians.

FIRST TURBINE STEAMER TO MAKE LONG VOYAGE.

Australia's first turbine steamer the "Loongana" was recently finished in England and covered the distance from the English dock to Australia in 32 days, 1 hour, 24 minutes (actual steaming time). The machinery worked without a hitch throughout. The first 3,300 miles were covered at a speed of 16 knots and 410 miles at a speed of 17 knots.

The vessel is 300 feet long, 43-foot beam and 12 feet deep in the water. She is to be used for the speedy transit of mails up the Tamar river to Launceston, Tasmania.

How to Make a Portable Electric Heater

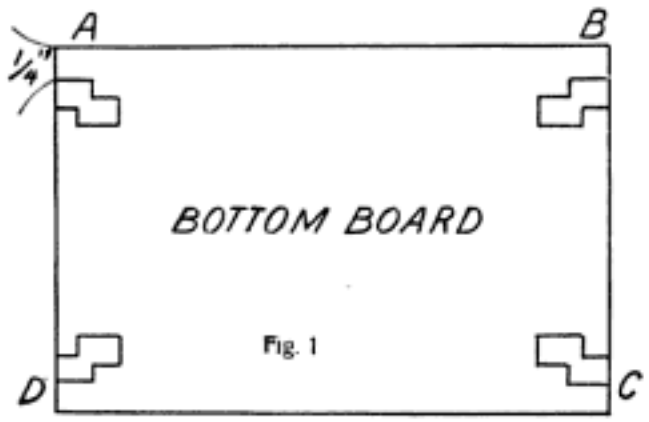
By Harry H. Townsend.

Anyone can make the portable electric heater described below, without the use of an ohmmeter or the necessary apparatus for finding the resistance of wire. The construction is very simple and the materials required few and inexpensive.

Select two boards 17¾ in. long by 6¾ in. wide by ⅝ in. thick; dress and sandpaper one side of the best of the two boards. These are for the top and bottom, and must be nice and smooth.

Select four pieces 9½ in. long, ⅝ in. thick and 1½ in. wide; these pieces are for the standards that hold the top and bottom boards together. They must be set or screwed to the top and bottom boards, as indicated in Fig. 1.

A, B, C and D are the four pieces for the uprights; these must be set perpendicular to the bottom board and must fit the top the same as the bottom. These pieces had best be put on with screws, so they will fit tightly. In Fig. 2 is shown their dimensions. These pieces must be placed so as



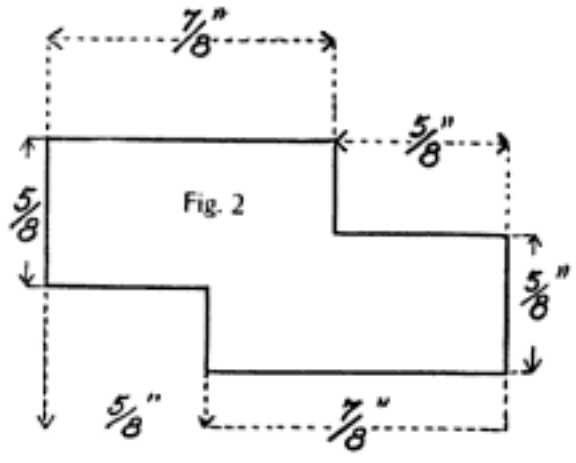
to leave a margin of ¼ in. on the sides and no margin on the ends, as per Fig. 1. When this is done we have a frame which has neither sides nor ends excepting the four uprights.

We can now wind our coils for the heater. Cut 28 pieces 16 ft. long from a coil of broom wire; this wire is used in broom factories, and it is also used by tinners. It can be bought for 8 or 10 cents a pound, and 2½ lbs. will be enough. The gauge is No. 19 B and S.

Wind each one of these 16-ft. wires upon a ½-in. iron rod; be sure and wind it close and tight, so that when you take it off the rod it will present a closed spring.

After they are all wound (14 to each set), they must be joined together, as in Fig. 3. Fourteen of these coils must be made as if they were one coil, as per sketch, and 14 to make the other coil. We will then have two coils in the heater, and either or both of them can be turned on or off at once.

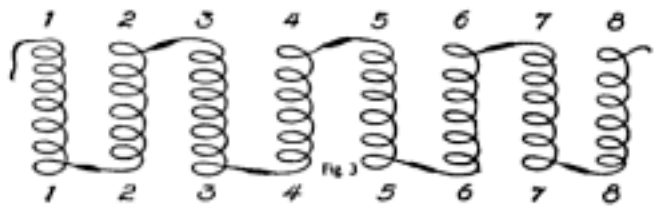
These coils must now be put in the frame so that they will not touch any of the coils in either set. They can be fastened to the top and bottom boards with double-pointed tacks. Care should be taken about driving



the tacks in far enough, because if they are not they will break loose and make the sides of the coil springs touch each other. The free ends of each set of coils will be used for connecting up to the circuit, so that they will not be cut off.

Cut two pieces of sheet iron 15⅞ in. long, 9½ in. wide; also two pieces 5⅜ in. long by 9½ in. wide for the ends. These pieces should be perforated with a ½-in. punch. The maker can select some pretty design, so that the punchings will not look rough when done.

Fig. 4 is a home-made fuse block, ½ in. x 2⅞ in. x 6 in. Binding posts, 1 and 1′, are 1 in. high and are larger than the other ones. The current comes in at 1 and 1′ and passes by wires to 2 and 2′, thence by fuse wire to 4 and 4′, and then by wire to 3 and

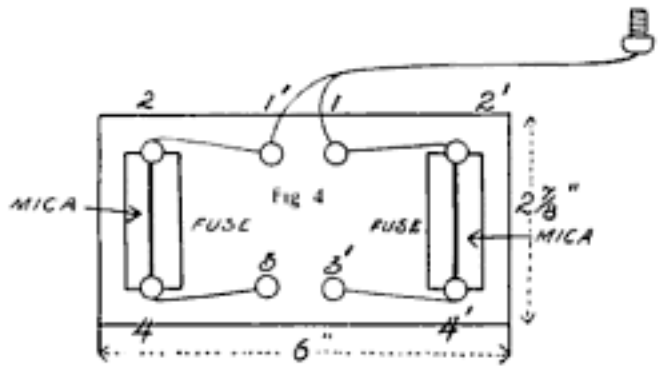


3′. The only binding posts that we will use for the stove will be 4 and 4′, 3 and 3′, and for the current intake 1 and 1′.

This block is made of poplar or any other kind of lumber, as it is thoroughly protected by the mica. It can be placed about 1½ in. from one end of the heater and fastened there. After being fastened bore four small holes exactly beneath posts 4 and 4′ and 3

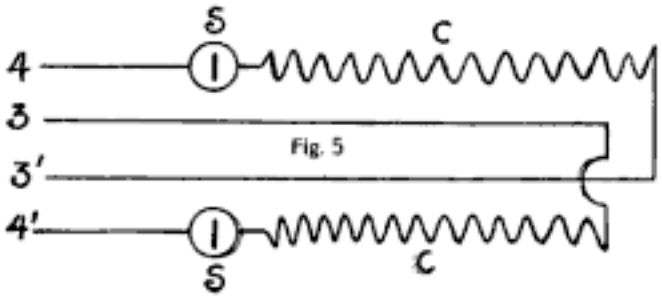
and 3' and then make connections, as in Fig. 5.

The switches can be placed on the top of the heater, opposite the fuse block, and in



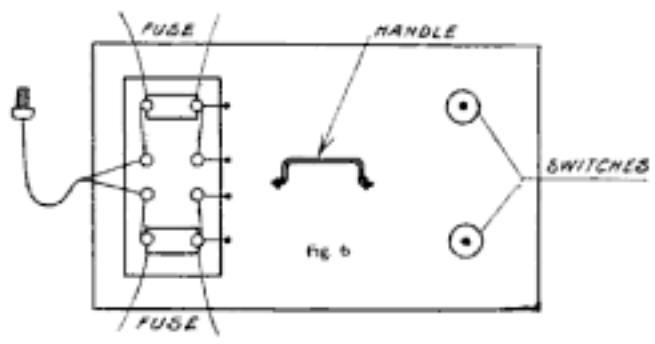
the middle can be fastened a convenient handle. The top view will be like Fig. 6 when completed.

Before the sheet-iron pieces are put in, the four standards should have some small strips put in between them at both top and bottom, so that the strips will not fall through, and also 16 holes should be bored in the bottom board in the center with a ¾-in. bit. The bottom boards should have a small leg, diameter, ½ in. x 1 in. long,



so the cold air can circulate to the heating apartment. Then place the sheet-iron strips in and fasten them with little strips.

The coils are made for 104 volts, but if the wood gets too hot, paint it with fireproof paint and it will be all right for 110 volts. The cost of such a machine should not exceed 75 cents.



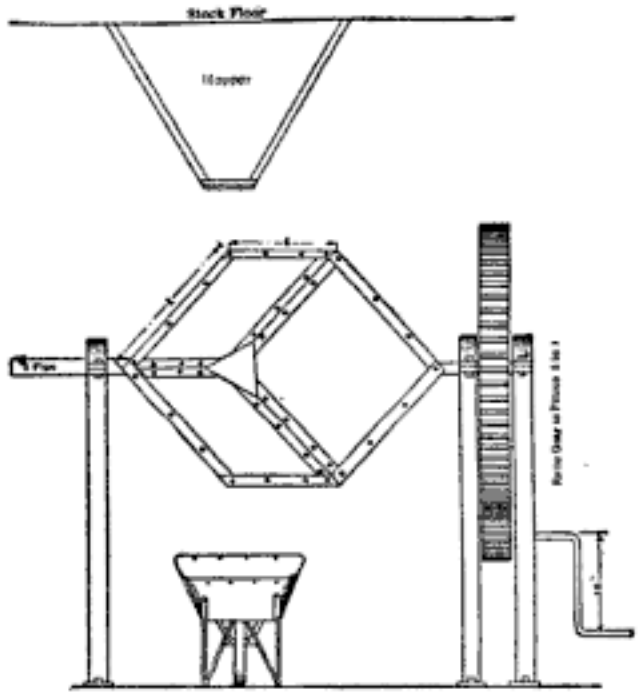
The sheet-iron pieces should be made with as many holes in them as possible.

When through using a square wipe all perspiration marks from it, and occasionally put on a few drops of oil. Never use emery or sandpaper on nickel or black finished squares.

HOW TO BUILD A CONCRETE-MIXER.

To build the concrete-mixer shown in the illustration line a cubical wooden box with No. 10 sheet steel and arrange an iron manhole at one corner. Mount the box on two corners or trunnions, one of which is a piece of 3-inch pipe, through which water is introduced and the other of which is connected to a hand-crank by means of a gear-wheel and pinion.

Turn the manhole up to receive the charge from the hopper and then fasten it down. Revolve the box a few times to dry mix the ingredients, then introduce the proper quantity of water by hose and nozzle through the hollow trunnion, and revolve the box as long as necessary.



Home-Made Concrete Mixer

To discharge the contents into a wheelbarrow to be transported to the work, remove the manhole and rotate the box part way. Do not have the mixer placed so far away that a long trip on the wheelbarrow is necessitated, or the liquid will separate from the material and, if the wheelbarrow leaks, will run out and reworking the concrete will be necessary.

This apparatus was highly recommended by Henry W. Edwards of Grand Junction, Colo., in a paper read before the Atlantic City meeting of the American Institute of Mining Engineers.

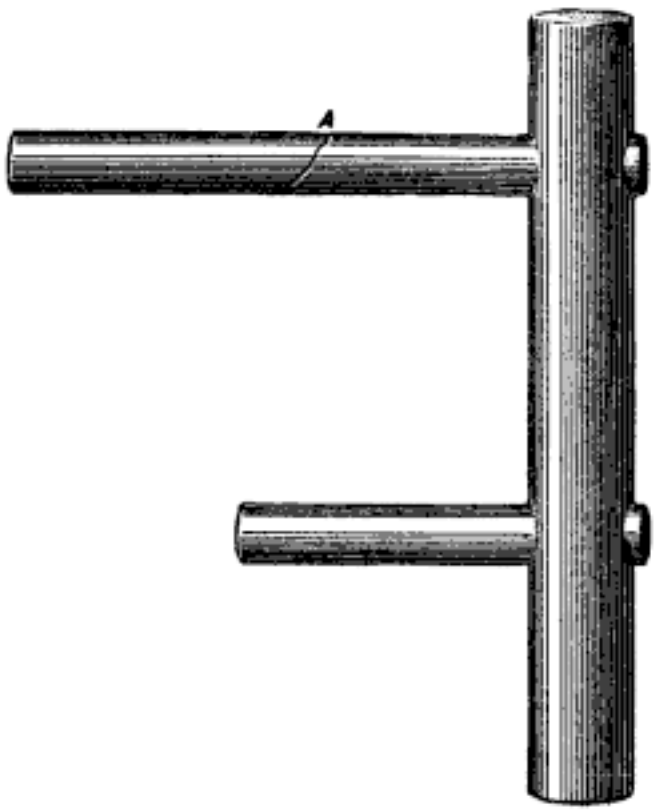
The following paste is good for keeping wood light: One-fourth pound beeswax scraped into one-half pint of turpentine. If it is wished to darken the wood add linseed oil.

SHOP NOTES

A SPECIAL METHOD OF BRAZING CAST IRON.

The following process is given by a correspondent of the Blacksmith and Wheelwright as his particular method of brazing cast iron. The illustration shows a piece of windmill, all in a solid cast piece, with a break at A, and brazed from the inside in the manner described. The writer says:

"I take 1 part of pulverized glass, 2 parts of ground marble, ½ part of carbonate of



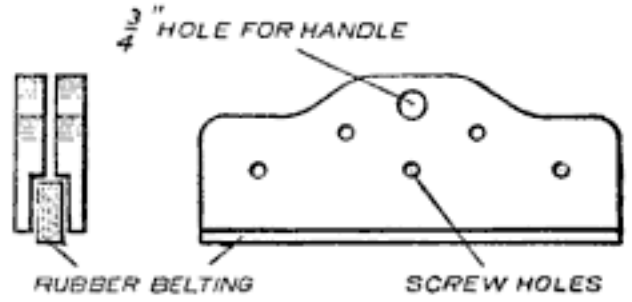
Brazing Cast Iron

iron, 2 parts of pulverized borax. For flux take 1 part of water and 1 part of pulverized borax. To grind your marble and iron take a bastard file or an emery wheel about No. 36 grit, so as not to make filings too fine. To pulverize the glass I take a piece and hammer on it on my anvil. One learns in a few hammerings the best way to pulverize it. There is a trick in it, but I don't know how to explain it.

"When your casting is ready to braze, take your mixture and the flux and make a paste and put a thin coat on each piece and bolt, strap or wire them together so they will not move while in the fire. Put it in clean fire and heat to high red heat; put your brass spelter on it till it melts; use plenty of it on your work to be sure of a good job. When the brass is melted, cut off your blast and let it rest there till it turns nearly black, then you can remove it and put it away so you can use your fire if you are rushed. When cold take off braces, bolts or wire, whichever it may be, file up and your job is ready. Now remember, if there is any dirt or grease you won't get rid of it. I heat the iron to a red heat and use steel brush and give it a good brushing. Then let it cool. Don't bolt the braces too tight together; if you do, when you heat your casting it will expand and your brass won't go through where it should. You must use borax the same as if you were going to weld steel. To braze iron or steel do not use glass or malleable iron; use only borax with some carbonate of iron, and of course you must use the brass. You must cake your coal so there will not be too much sulphur or gas in it to spoil your job."

MAKING A FLOOR-CLEANER.

The floor-cleaner shown in the sketch was made by a correspondent of the Engineer from some rubber belting about 3 in. wide and 18 in. long. Two pieces of hardwood 6 in. wide, 18 in. long and ½ in. thick were cut in the form shown, and put



Rubber Floor-Cleaner

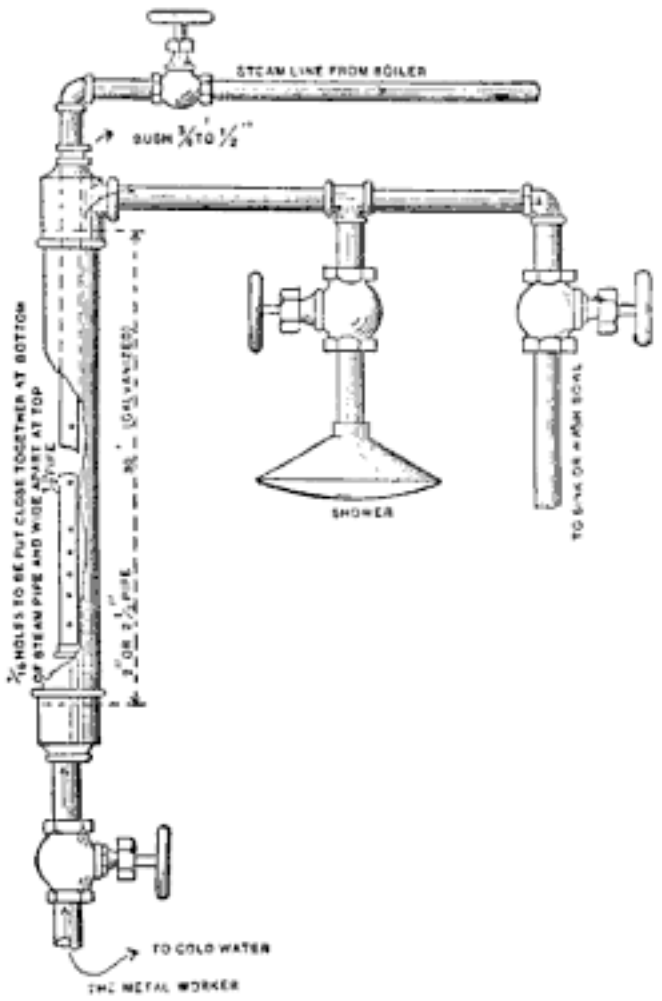
together with the rubber between them, so that the rubber projected below the wood about ¾ inch. An old broom handle was inserted and the cleaner was complete.

The floor on which this was used was a cement one, and the cleaner worked well for pushing water out of the room. It is also good as a mop for drying a floor after a scrub-down.

Aluminum, because it withstands the action of acids, is a suitable material for hooks for removing photographic negatives from acid baths. It makes good acid funnels, also.

WARMING WATER FOR SHOWER BATH OR WASH BASIN.

There are many establishments where steam is available in which a shower bath can be used with advantage by the employes of the plant, for their refreshment in the summer season, and for purely bathing purposes at the end of the day's work all



The Shower Bath

the year round. At a recent meeting of the Pacific Coast Gas Association the device shown in the accompanying illustration was presented in the "Wrinkle Department" for the consideration of men working in gas manufacturing establishments, and was met with strong approval.

It is made with a piece of 2-inch or 2½-inch pipe 2½ feet long. At the lower end it is reduced to ¾ inch. Where the cold water enters at the upper end there is a reducing T to ¾ inch. The side opening is where the hot water is taken off to the shower or basin. At the top of the T there is inserted a perforated tube of 1½-inch pipe with cap on the lower end. This tube is connected with the live steam line. The user can get the desired temperature of water by adjusting the valves on the cold water and steam inlets. This will be found very handy and a cheap shower for use at the works or any place where steam is to be had.

THINNING ZINC PAINTS.

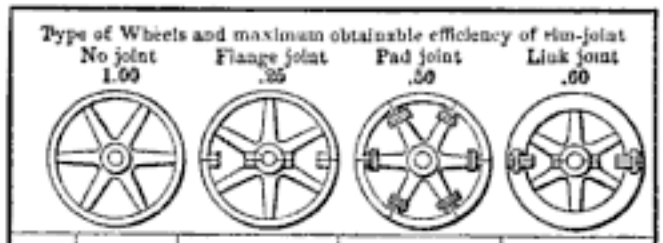
The proper medium for mixing zinc white is pale boiled oil. Many firms manufacture pale boiled oil especially for this purpose, and the painter will ordinarily save himself considerable trouble by procuring this proper medium at the outset.

In mixing zinc paints, use as much oil and as little turpentine as possible, the oil being pale boiled, and keep the paint as "round" as possible. All zinc paints can be applied much rounder than lead paints.

Oxide of zinc and sulphide zinc white, when ground in oil in the form of a stiff paste, should be kept from air in the stock casks, and whenever a portion is removed the surface should be smoothed down and covered with a little raw linseed oil. Never use water, but always oil, for covering the surface of zinc paints.

SAFE SPEEDS FOR GRAY-IRON FLY-WHEELS.

The following valuable table of safe speeds for gray-iron flywheels has been compiled by W. H. Boehm, superintendent of the flywheel department of the Fidelity and



Diam. in Ft.	R.P.M.	R.P.M.	R.P.M.	R.P.M.
1.	1910	955	1350	1480
2.	955	478	675	740
3.	637	318	450	493
4.	478	239	338	370
5.	382	191	270	296
6.	318	159	225	247
7.	273	136	193	212
8.	239	119	169	185
9.	212	106	150	164
10.	191	96	135	148
11.	174	87	123	135
12.	159	80	113	124
13.	147	73	104	114
14.	136	68	96	106
15.	128	64	90	99
16.	120	60	84	92
17.	112	56	79	87
18.	106	53	75	82
19.	100	50	71	78
20.	96	48	68	74
21.	91	45	65	70
22.	87	44	62	67
23.	84	42	59	64
24.	80	40	56	62
25.	76	38	54	59
26.	74	37	52	57
27.	71	35	50	55
28.	68	34	48	53
29.	66	33	47	51
30.	64	32	45	49

Casualty Company. The American Machinist says: "The table is figured for a margin of safety on speed of approximately three, which is equivalent to a margin on stress developed, or factor of safety in the usual sense, of nine."

CARE OF PACKING RINGS.

Packing rings used by air brake repairmen should never be hung on nails or hooks, as they are soon sprung out of a true circle by their own suspended weight, necessitating much filing away of the ring to make

Effect of Hanging on Nails

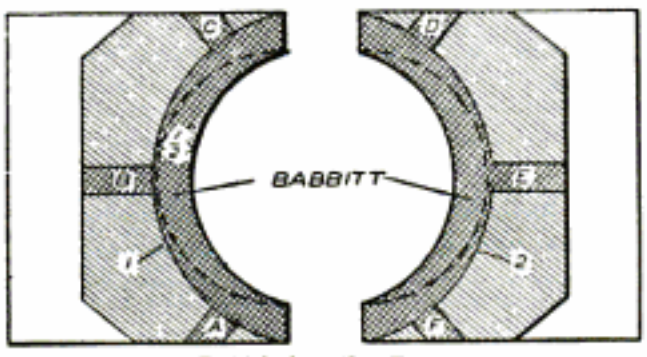
it fit the cylinder. This, says Locomotive Engineering, is especially true of governor, triple valve and equalizing piston rings.

For the small rings use tin boxes slightly larger than the rings, which should be laid flat in the box. Large air pump rings should be laid on shelves. If thus cared for, the circle will remain true and the rings may be readily fitted.

TO REPAIR CRANKPIN BRASSES.

The sketch shows a worn-out wristpin box from a high speed engine, the dotted lines showing where the pin had worn the metal away. A correspondent of the Engineer tells how he repaired it.

It was taken out, put in the lathe and bored out to the lines 1 and 2, and the six ½-in. radial holes (A, B, C, D, E, F) were drilled. A pin of dry wood ⅛ in. smaller in



Babbitting the Box

diameter than the wristpin was then turned and the boxes babbitted around it. The boxes were then put in the lathe and bored out to the size of the pin. The oil grooves were cut and the rod connected. The brasses have never given the least trouble since the repair and the babbitt does not require keying so often as the brass box did.

VISIBLE SIGNALS FOR TELEPHONES.

In a factory or plant where there is considerable noise at all times and where the room is so large it is not always possible to hear the telephone bell, an ingenious arrangement for visible signals may be used to advantage.

Red incandescent lamps of about 16 candlepower each will serve as good signals and several should be placed at various points where they will be likely to be noticed, if automatically turned on. Connect them all on the same pair of wires and run these to the telephone.

On the back of the closet or partition where the telephone is placed mount a block

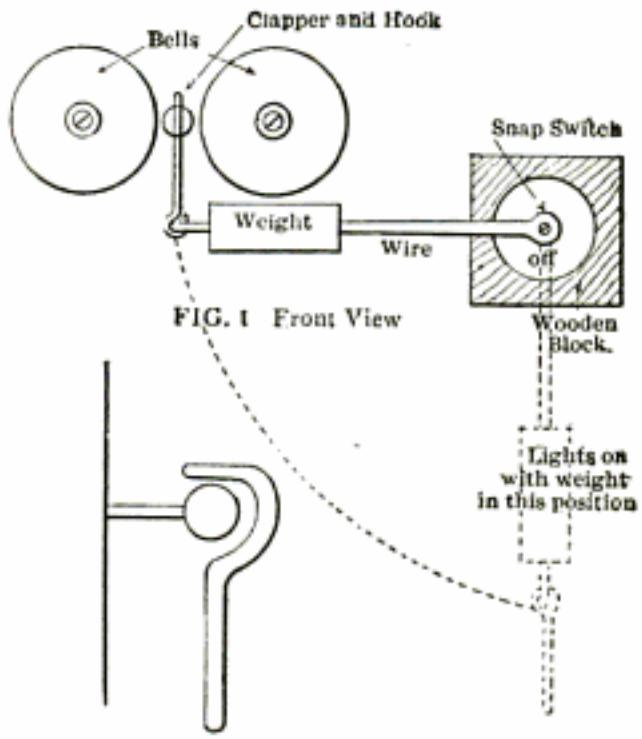


FIG. 1 Front View

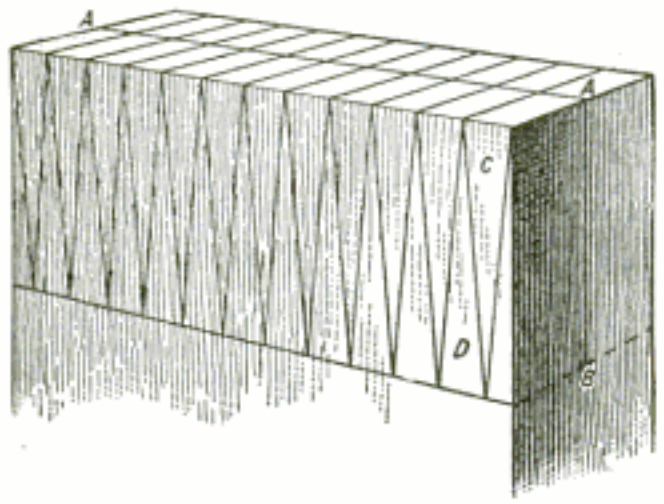
FIG. 2 Clapper and Hook

of wood thick enough to have its upper surface flush with the magneto case. On an ordinary snap switch without a handle attach a long bar having a weight at its outer end and small hook made of copper wire. Mount this on the block. Slip the hook over the clapper of the bell and balance it. Figs. 1 and 2 show this arrangement clearly. When the telephone bell rings, the hook will slip off, the weight fall and the switch will throw on the red lights, notifying any one in any part of the room who may see them that there is a call at the 'phone.

This ingenious apparatus was first used in a large steel mill where news of a fire in the town was noised abroad by the boiler house whistle upon notification over the 'phone, says a correspondent of the American Machinist.

A GOOD METHOD OF SAWING WEDGES.

For this purpose use a good, stiff back saw, sharp. First saw line A A down to B. Second, saw wedges C out and then raise them up one-eighth inch to make a guide for the sharp ends of the wedges D, all of



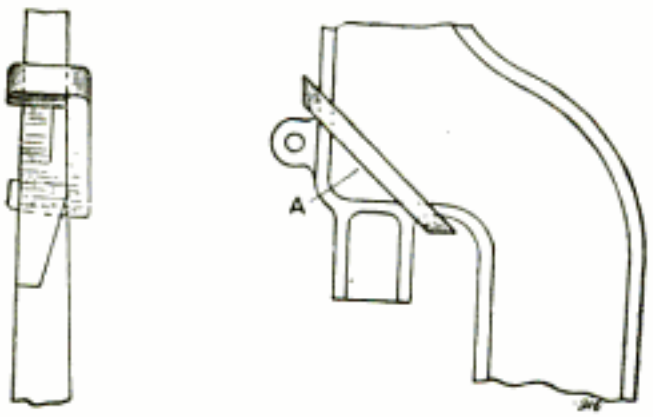
Sawing Wedges

which saw off at the line B after the C wedges are sawed off.

"We use pitchy floor scraps," says a correspondent of the Blacksmith and Wheelwright, "and after the first wedge cut, every cut makes two wedges, and they stick better than a shaved wedge."

BRACING A STEAM-HAMMER FRAME

A crack developed in one of the standards of a 10-cwt. steam hammer while some large motor pinions were being forged a short time ago. The Electrical Magazine, London, tells how the standard was braced



Bracing a Steam-Hammer Frame

so that though it has been used for heavy jobs several months it shows no sign of breaking more.

The crack is shown at A. A 2-in. square bar of steel was forged to the required shape, as shown in the sketch. Cooling contracted the bar and so braced the frame.

There were produced in the United States last year 280,000 tons of lead.

HOW TO FIX PEARL TO GLASS.

The design desired should be first carefully gilded in outline and the spaces between the lines filled with very clear varnish. Allow this to become tacky, and then with a little size on the end of the finger pick up some of the flakes of pearl, put them on different parts of the letter; fill in with smaller flakes and press some pearl powder on to cover the space completely.

Apply the varnish with a soft hair fitch, says the Master Painter and when the work is quite dry press a layer of tinfoil well into the breaks to fix the pearl to the back. Paint over with tinted white lead, mixed stiff in boiling oil with sufficient japan gold size to dry quickly.

A SIMPLE METHOD OF BURNING OUTLINE LETTERS ON GLASS.

Write the letters in with a weak solution of white matting acid. This will roughen the surface of the glass. Gild the letters with isinglass size, bringing the gold beyond the letters in order to obtain a bright margia line. Then write the whole of the letters, center and edges, with japan gold size and red lead. When dry remove surplus gold with water. Varnish, japan gold size or coachmaker's black japan makes a good protective backing.

CLEANING BOILER TUBES.

In discussing a previous article in the National Engineer Chas. B. Risley says:

There seems to be no objection to the use of a scraper as a cleaner of boiler tubes, except the laborious task necessary when it is used, as against the comparatively easy work of operating a steam blower. In my opinion neither of the above methods gives the best results. The great majority of scrapers are not efficient tube cleaners because they cause the soot in the tube to bulk up ahead of the scraper in a manner that necessitates the scraper passing over some of it and compressing to the sides of the tube, resulting in a poorly cleaned tube. The soot, so compressed, forms a surface upon which other soot finds easy and convenient lodgement.

With purely steam blowers, trouble arises from the fact that the moisture in the expanded steam, after leaving the cleaner, forms a scale on the tube that calls for the use of a scraper for its removal.

I believe that the hot blast flue cleaner will clean tubes more thoroughly than

either or both of the methods previously mentioned.

With the hot blast system we have, for example, for a 4-inch tube, a steam nozzle ¾ inch in diameter, which is used to syphon the gases from the furnace at approximately 800 to 1,000 degrees, the size of the gas inlet being 2¼ inches in diameter. In this way the volume of steam is superheated, thus preventing moisture or cold air entering the tube.

I have conducted a number of tests to determine the temperature and velocities of the discharge of steam tube cleaners, with results as shown in the following table:

TYPE OF CLEANER	Boiler pressure	Size of tubes	Size of steam nozzle	Area of air inlet, sq. in	Degrees of superheat	Temperature of discharge	Velocity in feet per second of discharge	Relative temperature to water in boiler
Hot Blast Blower	90 lbs	2¼-in	¾-in	3.14	112	334 F°	780	3 deg. above
Standard Steam Blower	90 lbs	2¼-in	¼-in	0	0	215 F°	270	116 deg. below
Steam Blower with Air Inlet	90 lbs	2¼-in	¼-in	3.14	0	150 F°	700	181 deg. below

FORGING HOLLOW SHAFTS HAVING LARGE HOLE IN CENTER.

Hollow shafts of large diameter having a large hole in the center which tapers toward the ends (Fig. 1) should be forged in the manner shown in Fig. 2. Bore straight through the largest diameter and then put the ends under the hammer or forging machine and bring them down to the diameter

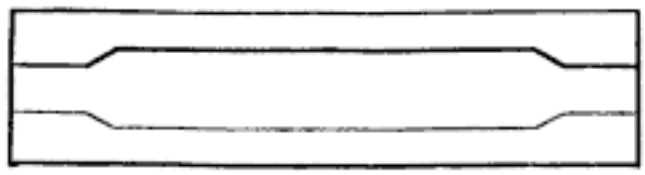


Fig. 1

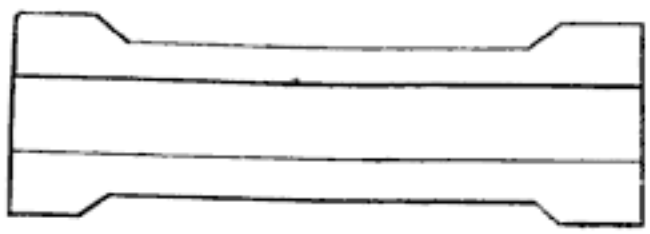


Fig. 2

of the rest of the shaft, says a correspondent of the American Machinist. This reduces the size of the hole at the ends and reinforces the shafts where the couplings are shrunk on.

Such shafts are used in our large men-of-war. In a 16-in. shaft the hole for a few feet at each end is about 6 in. in diameter widening into a hole 9 in. in diameter at the center.

HOW TO BURN OUTLINE LETTERS ON GLASS.

The following instructions apply where each letter is to be outlined with a burnished line ¼ inch wide, the interior of the letter being in a dull gold.

Lay the glass flat on the table, and for the parts of each letter which are to be in dull gold leave plain glass; plate coat the rest with embossing black. The exposed portions of the glass should then be eaten away with hydrofluoric acid, which will not attack the covered portions and will do its work in a few minutes to a half-hour, depending on the strength of the solution. To ascertain the depth to which the acid has eaten draw a needle or other fine steel instrument against the edge of the letter. When deep enough, pour off the acid and wash the surface of the glass with clean water. Remove the black with turpentine.

Gild the letters, allowing the gold leaf to come beyond the edge of the letters to the required width of the burnished line. Use a weak solution of isinglass as a medium. When dry protect the gold line by a coating of red lead and gold size. When this is hard the surplus gold may be readily washed off.

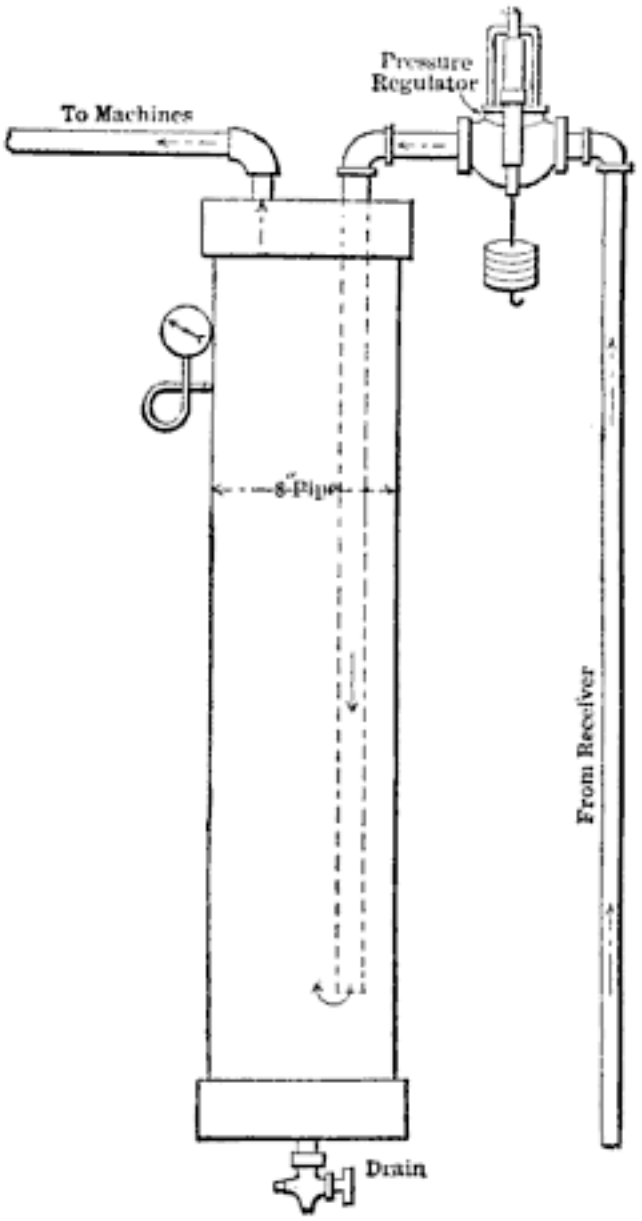
If the plate glass cannot be removed from the sash, the acid cannot be used in the manner described. In such case lay the gold around the edges of the letters on the back, on a weak solution of isinglass. Cut the gold on a cushion and place on the wet size. When dry, the gold from the face side will appear bright. It may be further burnished, if desired, by rapidly pouring hot water on the letters and allowing it to run off, using great care to prevent the gold washing off, if a weak solution is used. Paint the line of gold in with a backing of gold size or varnish and red lead, and when it hardens wash off the gold beyond the edge of the line. To make the letters appear dull done to the edge with isinglass, write the inner part in with pale varnish and when almost dry, gild.

Our readers are urged to contribute to "Shop Notes" any kinks which they have worked out, or may be using to advantage and which others might use with benefit.

MEANS OF REMOVING MOISTURE FROM COMPRESSED AIR.

Compressed air would be even more extensively used than it now is were it not for the presence of moisture which, in some instances, would do damage to the work in hand.

In a large plant where compressed air is used a great deal, the moisture was successfully disposed of after several means had been tried and failed, says Power.



Removing Moisture from Compressed Air

The receiver pressure being 80 pounds and only 25 pounds being necessary, a reducing valve or pressure regulator was installed, as shown in the sketch, which has made dry air a possibility.

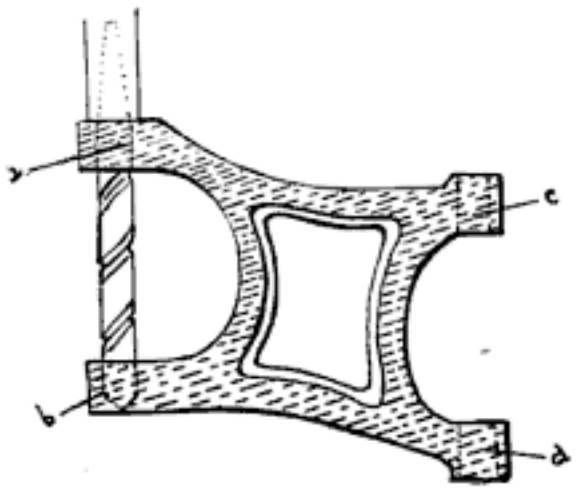
The drain shown at the bottom of the tank may be opened and a piece of paper held under it, and no moisture will be visible, except perhaps a little oil, if it has not been opened for quite a while.

Since this apparatus has been put in, there has not been any more trouble with moisture, and if it helped in this case it will surely help others.

LENGTHENING A TWIST DRILL WITH PAPER.

Some time ago I had a casting, as shown in sketch, to be drilled at a, b, c, and d, 1-inch hole. The holes had to be drilled absolutely in line through both lugs, for a 1-inch shaft to go through.

I clamped the casting to the angle plate, and after I had drilled through the lug, a, I found that the drill was not long enough by ½ inch to drill through lug b. Of course, I could have turned the casting around and drilled from the other lug, but this would have necessitated a very careful lining up to get them absolutely in line. Instead of



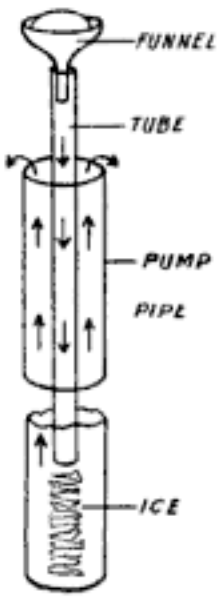
Distance Reached With a New 1-inch Drill.

reversing the casting, I took the drill out and wrapped paper around the taper socket on the drill, then by placing same in spindle of drill and tapping it gently, I succeeded in drilling through both lugs at one setting, and the drill never slipped in spindle.

I know of no rig that can be fixed up any quicker than this one, providing there is nothing at hand except the average length of drills.—Norman, Muscatine, Iowa.

THAWING A PITCHER PUMP.

To thaw a pitcher or common kitchen pump, unscrew the pump and put a hollow elder or small iron pipe down the main pump pipe. With a funnel at the top of the tube or small iron pipe boiling hot water can be made to reach the frozen part. Keep pouring the hot water. Two feet can be thawed in two minutes. Before retiring draw a pail of water so there will be a supply on hand.—Contributed by Carl Baum, Valparaiso, Ind.



HANDY TABLE FOR SPACING HOLES IN CIRCLES.

The following table for spacing holes in circles, sent us by J. C. Bush of Duluth, Minn., is a great time saver and avoids making numberless trials.

Suppose the problem was to divide a 62-inch circle into 44 equal parts. First find 44 in the table and on the same line under S is .071339. Multiply this by 62 which gives 4.423018 in. Having drawn two diameters at right angles to each other the dividers are set to 4.42, using a scale of one-tenth. Convenient for draftsmen and patternmakers.

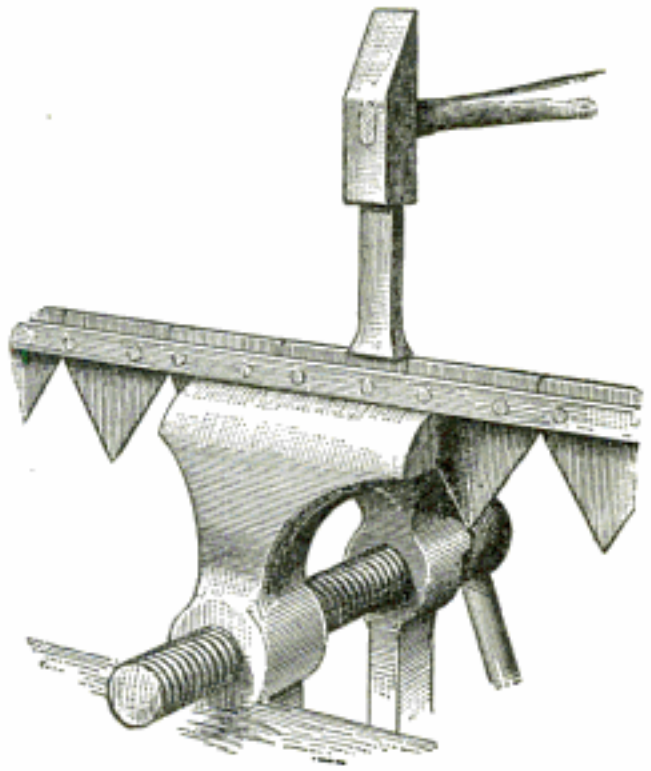
No.	Degrees.	Seconds.	Sine.
3	60	..	.8660
4	45	..	.7071
5	36	..	.5880
6	30	..	.5000
7	25	43	.4339
8	22	30	.3826
9	20	..	.3420
10	18	..	.3090
11	16	22	.2817
12	15	..	.2588
13	13	51	.2393
14	12	52	.2227
15	10	..	.2079
16	11	15	.1951
17	10	35	.1837
18	10	..	.1736
19	9	29	.1648
20	9	..	.1564
21	8	35	.1492
22	8	11	.1423
23	7	50	.1363
24	7	30	.1305
25	7	12	.1253
26	6	55	.1204
27	6	40	.1161
28	6	26	.1120
29	6	13	.1081
30	6	..	.1045
31	5	50	.1012
32	5	38	.0980
33	5	27	.0950
34	5	19	.0923
35	5	05	.0896
36	5	..	.0871
37	4	52	.0848
38	4	44	.0826
39	4	36	.0805
40	4	30	.0785
41	4	23	.0765
42	4	17	.0747
43	4	11+	.0730
44	4	5+	.0713
45	4	..	.0697
46	3	54	.0682
47	3	49	.0668
48	3	45	.0654
49	3	41	.0641
50	3	36	.0628

This table can be extended to any number by consulting Trautwin, page 1022.

To test the purity of turpentine drop a small quantity on a piece of white paper and expose to the air. No trace will be left if the turpentine is pure, but if it contains oil or other foreign matter the paper will be greasy.

EASY METHOD OF REMOVING KNIVES FROM SICKLE BARS.

This is a difficult task unless the smith knows just how to go about it, and comparatively simple when he does. Many a smith has tried to remove worn out or broken knives from mowing machine sickle bars by means of a chisel and punch, with the result that the rib on the back was either bent



Taking Knives from a Sickle Bar

double or broken in two, says a correspondent of the Blacksmith and Wheelwright.

To make an easy job of it, catch the knife to be removed firmly in a vise, having the rib on top of the vise but not caught in it. Then with a set hammer placed so it will just catch the knife and not the rib, drive downward, and the rivet will be cut off, as if by magic, between the knife and the rib. Cut but one rib at first, and then cut the other one, and the blade will then drop off. In this way ten blades can be knocked out in as many minutes without trying the patience too greatly.

TAKING SPUDS OUT OF BOILERS.

Plumbers often find it difficult to take spuds or nipples out of old boilers as in hammering spuds to loosen them one is apt to disfigure or split them. To take them out without injuring them heat nipple or spud with torch or furnace and when hot put on pipe wrench and unscrew. If it does not come heat a little more. This method saves time, trouble and noise.—Contributed by Arthur Ed. Hauslein, Chicago, Ill.

CLEANING FLOORS.

One pound of common soda and one pound of quicklime melted or mixed in one gallon of boiling water, is good for removing hard paint and restoring color of floors, says the Master Painter. Saturate the floor with the solution, sprinkle clean, sharp sand over it and scrub with soap and water. This will clean and bleach the floor perfectly and it may then be waxed.

WIPING JOINTS IN HARD PLACES.

Where a building is equipped with a wrought-iron pipe screw joint drainage system and where a joint must be wiped under the closet to connect the vent to the lead bend connecting the closet with the waste pipe, considerable trouble would be saved, says the Metal Worker, if the 2-inch vent pipe were connected with the lead bend before the cementing and tiling was set and if a 45 or 90 degree bend was made in the 2-inch pipe, so as to allow for any inaccuracy of the piping or fixtures when finally set. This would allow the pipe to be still further bent or straightened to meet the requirements. Some idea of the conditions met with under the floor where the joint must be wiped are presented in the plan and elevation given in Fig. 1. The dotted lines show the extent to which the lead bend may be moved in order to facilitate the wiping of a joint when the vent connection is made with the lead bend.

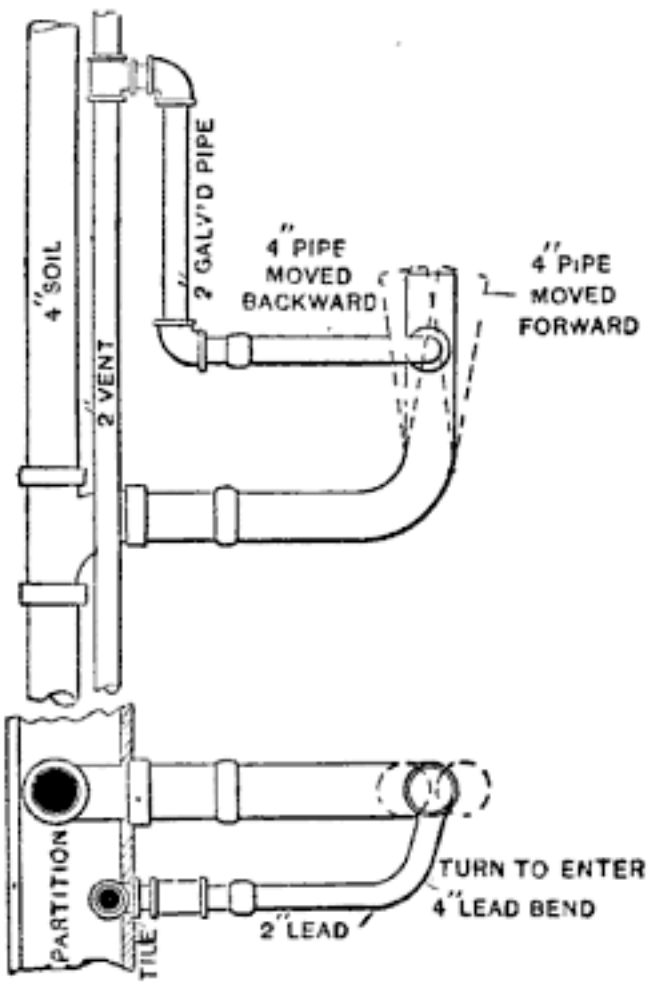


Fig. 1.—Where Joints Must Be Wiped

It is often difficult to hold the heat until the joint is properly made, where the pipe is as thin as the lead bend or the vent pipe. Fig. 2 shows an arrangement for maintaining the heat until the work is finished. An old piece of tin plate or sheet iron is bent in the form of a small basket with ends extending up to turn down over the end of the lead pipe and so support the basket at the point desired. Sufficient air spaces to allow free radiation of the heat and continued combustion of the hot coals which should be placed in the basket should be made. Perforations in the sheet metal will suffice. Stuff the top end of the bend with paper to prevent the generation of too much heat. This method is convenient where a pipe must both be dried out and heated before proceeding with the work.

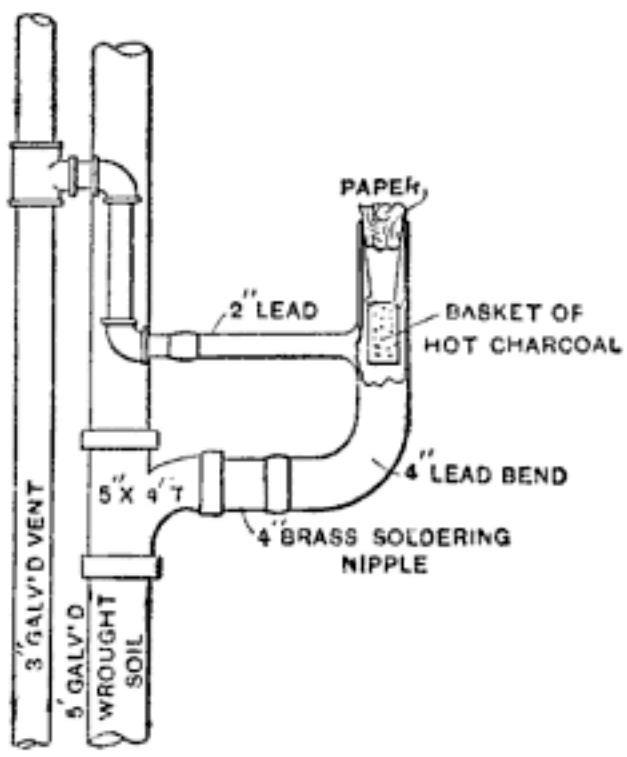


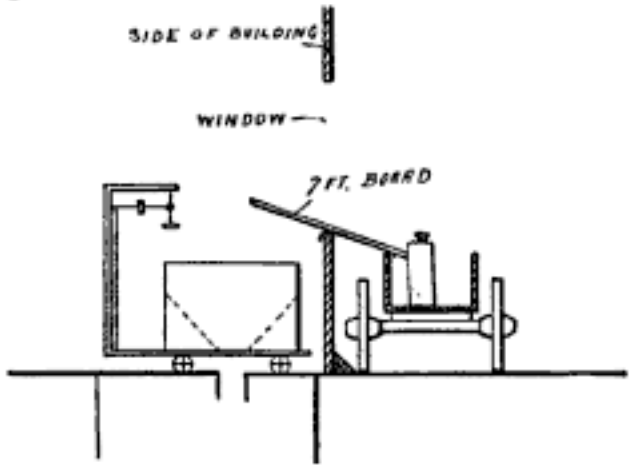
Fig. 2.—Getting Up a Heat

A SIMPLE FIRE EXTINGUISHER.

Where gasoline is used in any great quantity there is always danger of fire. In the ceiling over the tank containing the gasoline hang a fragile bottle containing about a gallon of ammonia, by a string or fusible link. Should the gasoline take fire the bottle will fall and be broken, releasing the ammonia and putting out the burning gasoline.

WHEAT DUMP FOR CUSTOM MILL.

The sketch represents a method of receiving wheat at small custom mills. The farmer places the sack on the board and lifts



Dumping Board

it up until it tips, says the American Miller. Then the sack slides in and empties in a hopper scale. The advantage of this is that every sack of grain can be inspected, to say nothing of the saving of labor.

SOLDERING CAST IRON.

Soldering cast iron is a rather unsatisfactory undertaking at best. The ordinary killed acid is the best flux to use, says the Automobile. The surfaces to be united should be made bright and clean; this is most important. They should then be tinned separately and sweated together. The pieces must be kept hot, as any tendency to chill the solder will cause failure, and the parts should be pressed together as closely as possible while cooling. It will be seen at once, on commencing the tinning process, that solder has not the same tendency to adhere to cast iron as to brass, for instance. For this reason a soldered joint in cast iron can never be depended upon to stand much strain. Some of the better and closer cast irons can hardly be soldered at all. Gasoline motor cylinders are usually exceedingly difficult to solder.

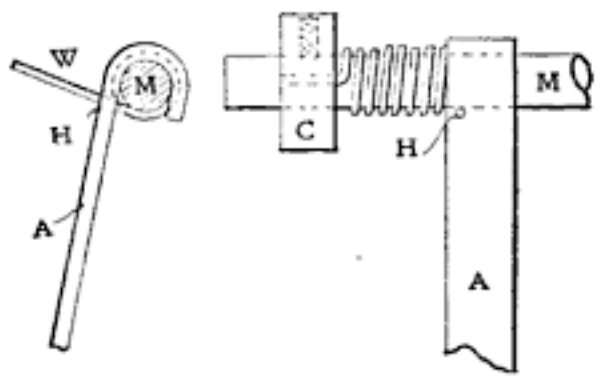
PREPARING TRACING PAPER

The following is a capital method of preparing tracing paper for architectural or engineering tracings, says the National Builder: Take common tissue or cap paper, any size sheet, lay each sheet on a flat surface and sponge over (one side) with the following, taking care not to miss any part of the surface: Canadian balsam, two pints; spirits of turpentine, three pints, to which add a few drops of old nut oil; a sponge is the best instrument for applying the mixture, which should be used warm. As each sheet is prepared it should be hung up to dry over two cords stretched tightly and parallel, about eight inches apart, to prevent the lower edges of the paper from coming in contact. As soon as dry, the sheets should be carefully rolled on straight and smooth rollers covered with paper, about two inches in diameter. The sheets will be dry when no stickiness can be felt. A little practice will enable any one to make good tracing paper in this way at a moderate rate. The composition gives the substance to the tissue paper.

ANOTHER DEVICE FOR WINDING SPRINGS

Either close or open wound springs of any pitch may be wound by the device shown in the sketch, says a correspondent of the American Machinist.

Make the piece A of a suitable piece of flat stock, long enough to rest against the front of the lathe bed, and bend to fit over the mandrel, M. The mandrel should be smaller than the finished spring by the amount of spring in the material being wound. Drill the hole, H, a trifle larger



Winding Springs

than the wire used, and chamfer its edges a little. Its position determines the pitch of the spring; the pitch being steeper the farther the hole is from the left. This bends the wire just at the point where it goes on the mandrel. Do not hold back on the wire, as there is practically no waste. The collar, C, mounted on the mandrel, has a hole drilled longitudinally in it, for receiving the end of the wire.

To wind a spring, grip the mandrel in the lathe chuck, pass the wire through the hole, H; bend the end of the wire over at right angles and insert in the hole in the collar, C. Start up the lathe and wind the spring. Use a fairly stiff mandrel and no support for the outer end will be necessary. For slender mandrels an old chuck mounted in the tail spindle may be used, having the jaws tightened enough to support the end of the mandrel.

RAISING THE STACK.

The raising of a tall stack always becomes a matter of popular interest before it is accomplished and any bungling may bring embarrassment to the man superintending the job, who, in all likelihood, had not counted on the group of interested spectators. A correspondent of the Woodworker tell how he goes about this operation.

Fig. 1

Derrick pole, blocks, tackle and all necessary rigging were collected soon after the construction of the building had been started, as it is good policy to have them at hand and in readiness. The derrick or "gin" pole usually consists of three poles set in a tripod. In this case a poplar log "snaked" up the bank was the best available. The pole was 54 ft. long and 10 in. in diameter at the top end; the brick stack stump was 18 ft. high and the iron stack built and the pole set on it, which gave about 9 ft. of space between blocks when the stack was "high," ready to set over into place.

Blocks and tackle consisted of a double or two-sheave block having a becket to which was fastened one end of the 1¼ in. rope (500 ft. long) and a triple or three-sheave block. The other end of the rope was the "fall" of the line—or the rope to which power is applied. It was passed four times around the "crab" of the drum, which "crab" was a geared windlass consisting of a crankshaft, having a crank on each end and carrying a small pinion which geared into a spur gear, keyed onto one end of a spool shaft. The spool was tapered down from the flanges toward the middle so that the rope slipped toward the center as wound on, and one man pulling on the slack end would cause it to impinge on the spool enough to raise the load pulled by two men at the cranks. This crab was geared so that the pinion made six turns to the spur gear's one and by means of it, with the tackle blocks, two men could raise a load

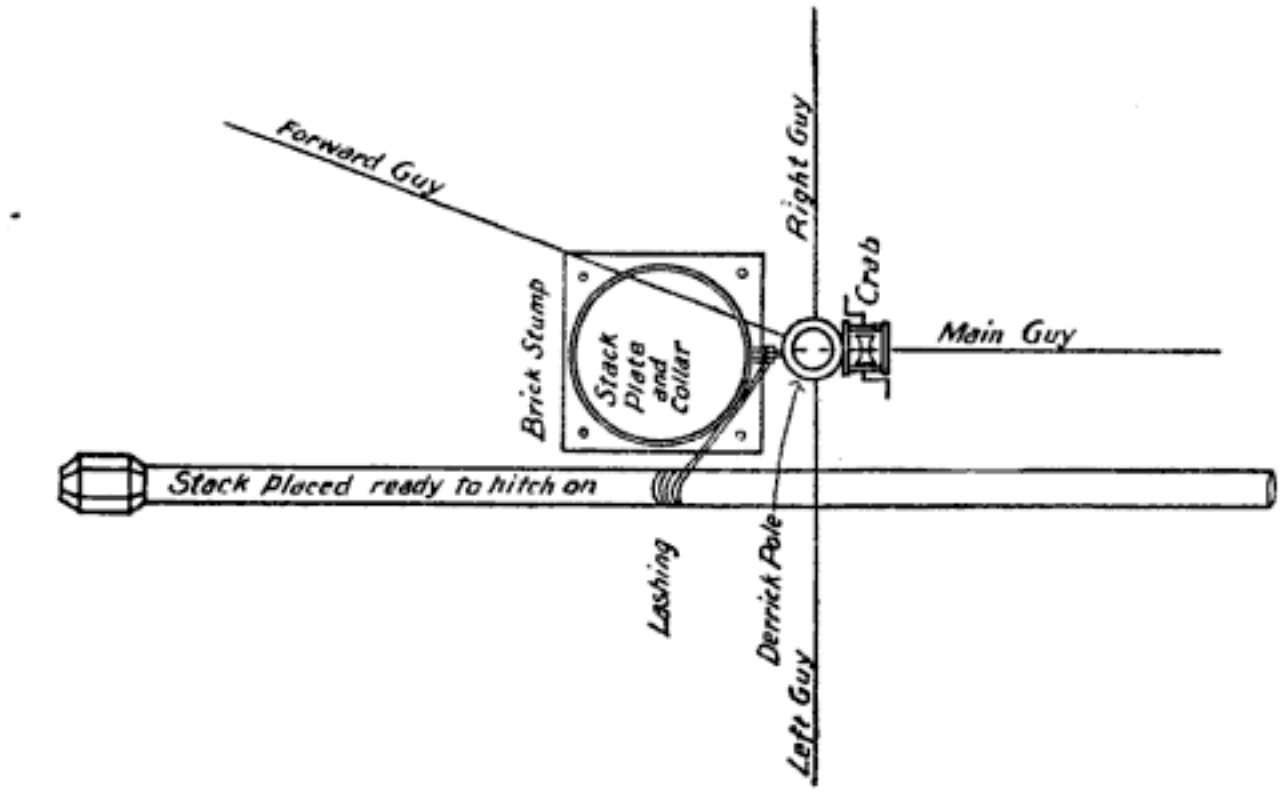


Fig. 2

with the spark arrester, was 87 ft. long, consequently the pole was not long enough.

To meet this emergency a butt splice was made at the large end of the pole by means of a 12x12-in. by 16 ft. timber and two pieces 6x12 in. by 12 ft. (Fig. 1.) This gave 70 ft. of pole, hardly length enough, allowing 10 ft. for blocks, sling and lashing for landing the pole in the stump. To gain length a crib of railroad ties, 5 ft. high, and having a platform of 2-in. planks, was of 8,000 lbs.—more than 5 men could pull up bodily by hand.

The derrick pole to be raised weighed 4,000 lbs. A 3x4-in. by 24-ft. scantling and a pair of double ¾-in. blocks were first raised by hand. With this a larger derrick pole 5x5 in. by 40 ft. long was pulled up and securely stayed with four guy ropes. Then by means of blocks, tackle and crab the main derrick pole was hoisted and guyed as shown in Fig. 2. Before performing

this last operation the guys to the main pole were all pulled very tight by means of a pair of small blocks, each guy in turn until the slack was taken out of them. This was done by placing a "stop knot" on the guyrope, fastening one block to it and another to a sling around the post to which the guy is fastened. The "stop knot" is tied as follows:

We will say the guy is a 1¼-inch rope and the stop knot rope ⅝-inch. Take hold

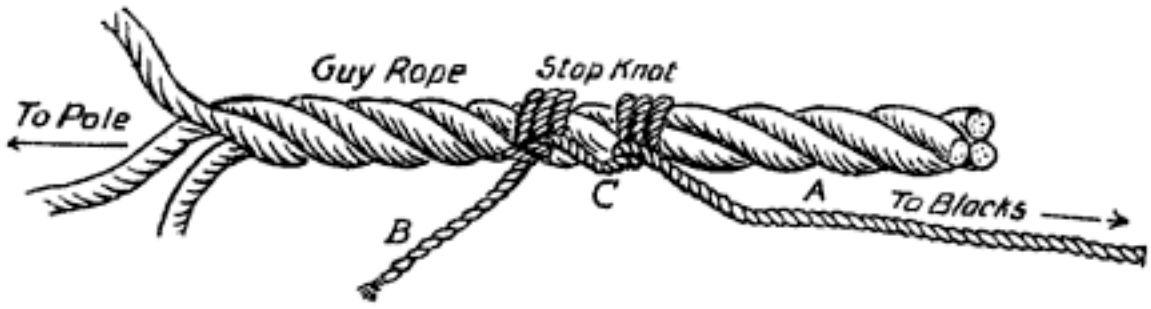


Fig. 3

of the end of the smaller rope marked A (Fig. 3), with the left hand; hold it against the large rope and make three round turns toward the right over the large rope. Bring the end of smaller rope, marked B, back, and take three half hitches to the left. Bring the end marked A through the loop at C, and attach to the hook of block that has the larger number of sheave pulleys. It is very important that the guy ropes should be pulled tight, so that the stack does not take a lurch and gain momentum enough to break one or more of them.

In the instance mentioned, the tackle blocks and rope were not raised with the pole. Before the pole was raised "cleat" steps about 2 ft. apart were put on and a 1¼-in. hole was bored in the top of the pole and a 1-in. round iron davit put in, the hook part hanging over toward the stump when the pole was up. A man went up carrying a small line with which he pulled up a pair of small blocks and with this tackle the large blocks and tackle were pulled up.

The appliances all being in place, the crab bolted to the foot of the pole, all the guys pulled tight, and the 'makefasts" all secure, the lashing was put around the stack 3 or 4 feet above the center of the weight of the stack—that is, so that the bottom end of the stack was a little heavier than the top. This lashing is usually a rope of the size of the block line, passed six times around the stack, and the hook of the lower block hooked into three of the turns, the other three pulling tight around the stack, to grip and not slip up. As all the weight of the stack comes onto this lashing near the center, if the joints are not very strongly riveted the weight of the ends will sometimes shear the rivets off at the joint nearest the lashing. To avoid this three ribs of angle iron, ¼x2x2 in. about 20 ft. long were put in, placed equidistant on the inside circle of the stack, lengthwise, and securely riveted to it. Some boiler builders furnish these angle bars to be put in full length of the stack, but unless the stack is of very light weight material it is not necessary except at the middle.

A set of four guy ropes were then fastened to the stack 11 ft. from the top and another set of four 13 ft. lower down. Everything was made secure and taut and then, the stack laying alongside (Fig. 2) the blocks were hooked into the lashing, the winding of the rope on the crab was begun and the stack slowly went up. The lower end was held down by a hand line and thus an upright position was gradually assumed. When at the right point, it was pulled over into place, settled down on the stack plate, plumbed and the guys secured to the eight posts previously set.

POINTERS ON ARMATURE COILS.

Wires should be of the proper size to obtain the requisite electromotive force, but as short and thick as may be, in order to give the least resistance possible. Their electro-conductivity should be of the best, good copper wires being nearly equal to silver. Coils should be wound with air spaces, as some heat is always generated by their resistance, and ventilation cools them. Mica and asbestos are good for insulating armatures.

The wind pressure upon a flat surface is twice that upon a cylindrical surface of the same height and width.

Eleven pounds of nails will nail on the 1,000 laths required to cover 70 sq. yds. of surface.

HOW TO MAKE A LEVELING BOARD.

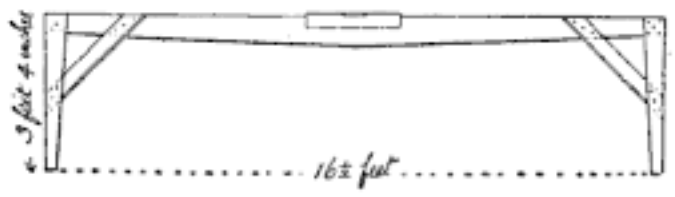
The board shown in the sketch is handy for grading pipe trenches or leveling ground. It may be made from an ordinary piece of lumber 6 ft. long, 8 in. wide and 1 in. or more thick. At the center and at right

Home-Made Level

angles with the bottom edge of the first board rigidly attach a piece of the same lumber, about 3 ft. long. At the top of this upright piece attach a plumb bob. Mark a scale on the bottom of the board and at the center. The swing of the bob will indicate the grade.

LEVEL FOR GRADING DITCHES.

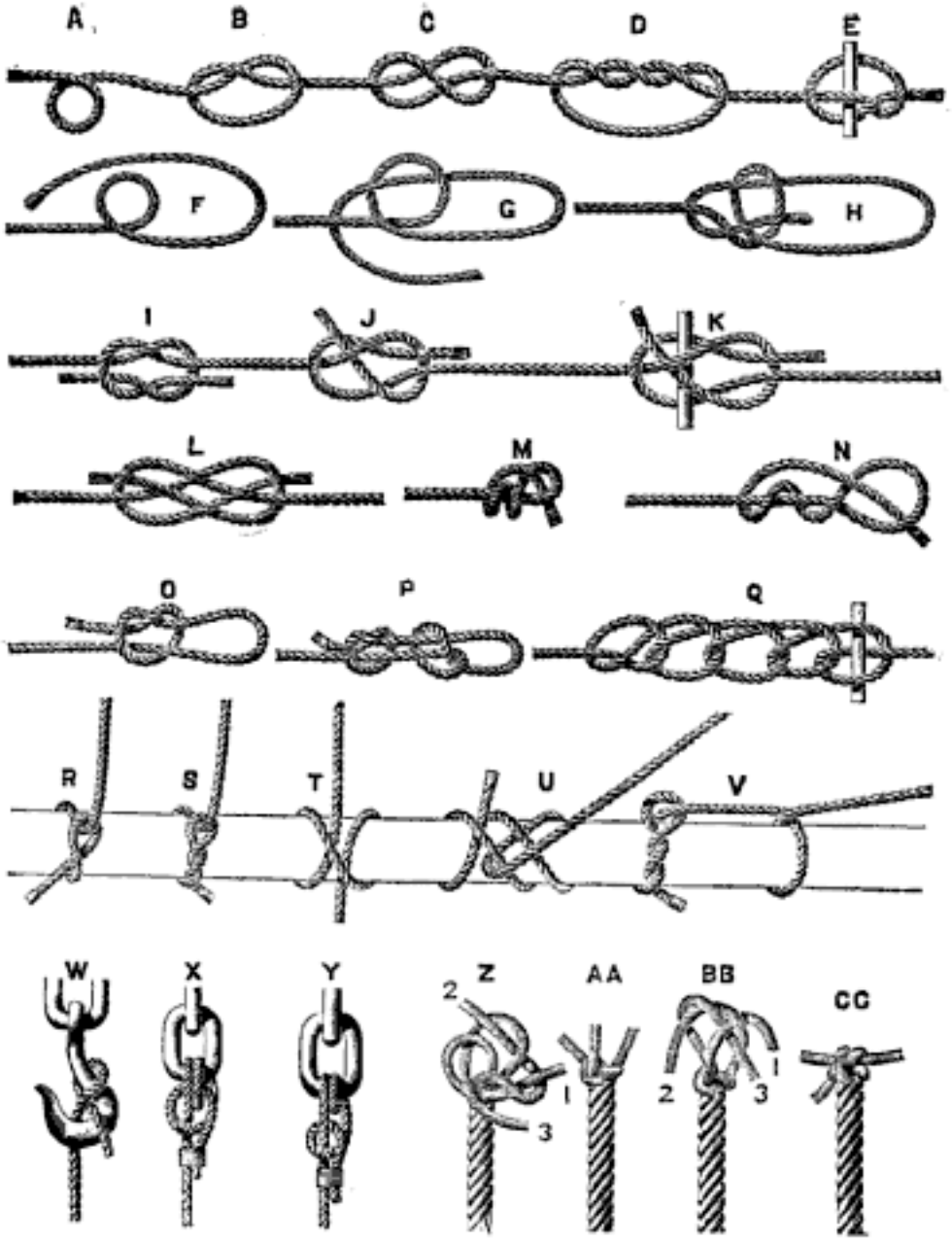
A level like the one shown in the illustration is used in Montana for grading irrigation ditches. The construction of the level is plainly shown. In operation the level is carried by one man and an assistant makes



Home-Made Level

marks with a shovel, to guide the driver of the ditcher, which follows about 200 feet in the rear. The usual grades allowed are from one-half to three-fourths of an inch to the rod. The level being just a rod in length is especially handy for the purpose mentioned.

Knots You Ought to Know



A.—Bight of a rope.
B.—Simple or Overhand Knot.
C.—Figure 8 Knot.
D.—Double Knot.
E.—Boat Knot.
F.—Bowline, first step.
G.—Bowline, second step.
H.—Bowline, completed.
I.—Square or Reef Knot.
J.—Sheet Bend or Weaver's Knot.
K.—Sheet Bend, with a toggle.
L.—Carrick Bend.
M.—Stevedore Knot completed.
N.—Stevedore Knot commenced.
O.—Slip Knot.
P.—Flemish Loop.
Q.—Chain Knot, with toggle.
R.—Half-hitch.
S.—Timber-hitch.
T.—Clove-hitch.
U.—Rolling-hitch.
V.—Timber-hitch and Half-hitch.
W.—Blackwall-hitch.
X.—Fisherman's Bend.
Y.—Round Turn and Half-hitch.
Z.—Wall Knot commenced.
AA.—Wall Knot completed.
BB.—Wall Knot Crown commenced.
CC.—Wall Knot Crown completed.

 Courtesy C. W. Hunt Co.

PUTTING RUBBER TIRES ON IRON BAND SAW WHEELS.

The following kink will be of use to those who experience some difficulty in making the tires stick. The reason they do not stick is because the wheel is cold and chills the shellac.

Fill a common oil can, having a small outlet, with gasoline. Have the wheel clean and keep it revolving slowly by hand. Put a little gasoline on all around the rim of the wheel and then touch a match to it and keep the fire all around the rim by putting in gasoline wherever the fire dies out. Keep this up until the wheel is very warm, then let the fire die out and put on very thick shellac and then the tire. The tire will stretch even all around and cause no more trouble by coming off.—Contributed by Chester R. Wyman, So. Paris, Maine.

HINTS FOR DRAFTSMEN.

Steel pens are soon ruined through not wiping, and even when faithfully cleaned after using, soon accumulate more or less deposit. They may be made as good as new in a few moments by rubbing with a bit of sandpaper until free from dried ink and rust. The sandpaper can be cemented on a tiny stick and take its place among the desk accessories, ready for instant use. Pens are cheap, of course, yet a good one one dislikes to part with, and the operation is so simple that it is worth while.

A fine or coarse pen can be created at will by means of an oil stone; a little practice will soon demonstrate the idea, rubbing at the sides reducing the lines, and across the end rendering the pen coarser. If any scratching ensues, a few trials will show where to apply the oil stone to remove the difficulty.

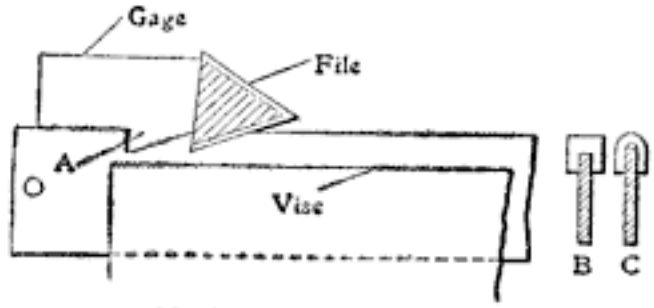
This method can be used to advantage also with etching pens. It sometimes occurs that the inking pens of a drawing set fail to ink properly and cut the paper. This is not only annoying but ruins the work. The oil stone, applied to each point after separating as widely as possible, will remedy the defect. Rub the finger over the points, to ascertain that there are no feather edges, and then continue with the oil stone until desired results are obtained. Afterward keep the tool clean. A little alcohol will be found good for this purpose.

When the glass in a slide rule is broken, the following will be found a good way to effect temporary repairs, until a new glass can be procured: Remove the broken glass, and cut a piece of cardboard to fit in its place; cut an opening to show the figures and lines, and string a hair across the opening, cutting a niche in the cardboard with a penknife for the hair, and being careful that it lines up properly. In this way one can use a slide rule until a new glass is obtainable.—Contributed by A. B. Weeks, Cleveland.

HOW TO MAKE A FINE-TOOTHED SAW.

Once in a while a saw having very fine teeth, fine as those on a jeweler's saw, but with a much wider blade is required. Such a saw can be made of an old spring from an eight-day clock, says a correspondent of The American Machinist.

The sketch shows the gauge made of ¼x½-in. machinery steel. Grind one side of a 3-cornered file safe, cut a piece of steel the length of blade you require and clamp in the vise; file one space A the proper depth, take the gauge in the left hand and apply in space A and file the next space,



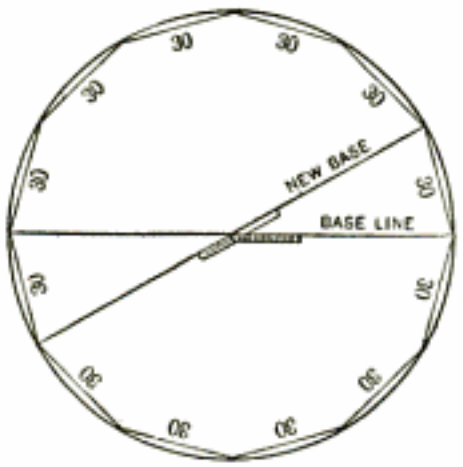
Making a Fine-Toothed Saw

holding the safe side against the gauge. Repeat this operation until the saw is complete. Regulate the depth by the number of strokes of the file. For thin brass or German silver tubing, one long stroke is enough; for flat stock, two; for hard rubber or fiber, three.

Punch holes in the ends to stretch in a frame, or for miter work make a back for the blade by slotting a piece of flat brass like B, or take a piece of soft brass and double over like C. If for any reason you should desire to draw the temper at each end, wrap the toothed part in a wet cloth, or, better still, stick through a raw potato and leave the end exposed and apply the heat. The temper is hard enough for gray iron and machinery steel. The blade can be made at the rate of 1 in. in 3½ minutes. No set is required. This saw makes a cut of .02 in.

DIVIDING CIRCLES BY THE STEEL SQUARE.

A circle may be divided into any number of equal parts by the use of the steel square, says the Metal Worker. To do this, divide 360 by the number of equal parts desired. This will give the angle of the parts in degrees.



Using Steel Square for Dividing Circles

Let us suppose that we wish to describe an octagon within a circle. Dividing 360 by 8 gives us 45 degrees as the angle of the parts. Set bevel square at this angle by aid of the protractor and from any diameter as the base line, secure a new base, using this from which to secure a second and so on until the circumference is completed. This proceeding is indicated in the diagram.

For a very large circumference, first make a small drawing, having a diameter which is a factor of the given circumference, keep in mind that dimensions of similar figures are in proportion and the sides may be secured by the rule of three.

BOILED OIL FOR ZINC PAINTING.

Mix 1 part of binoxide of manganese, in coarse powder, but not dusty, with 10 parts nut or linseed oil. Keep generally heated and stir frequently for 30 hours. The oil will then begin to turn a reddish brown and will answer for any paint.

FILLER FOR WALNUT.

To make a good walnut filler mix together equal parts of rye flour and china clay and a little burnt umber with two parts turpentine, one part boiled oil and two parts japan gold size. Apply with a rag.

If you have a good "kink" for this department, send it in. We can use rough sketches of any size.

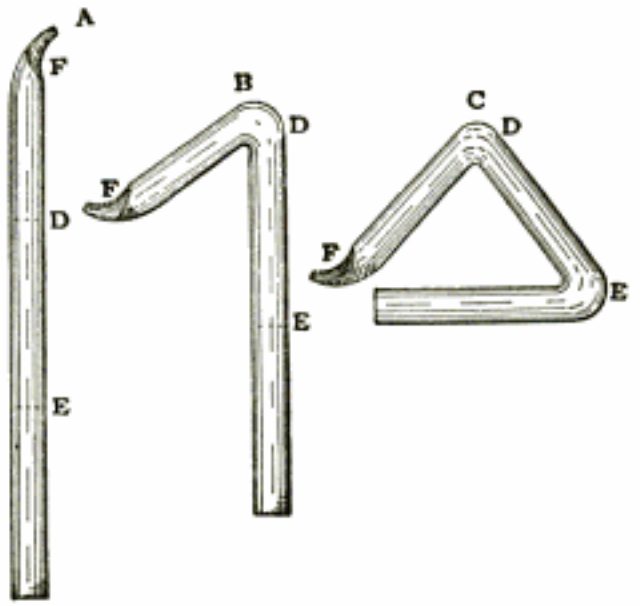
BLACK ENAMEL FOR WOOD.

Prime the wood with linseed oil, turpentine and while lead; give it two or three coats of black mixed with copal varnish and turpentine; rub it down dry with pumice stone and water, and then varnish with copal. Rub down again and polish with oil and rottenstone, which will give a perfect smoothness, says the Master Painter.

HOW TO MAKE A TRIANGLE.

A triangle which may be used by a lodge or other organization as a call instead of a bell or horn, is described in the American Blacksmith.

The triangle, which should be about 24 in. on each side, is made from a round bar of spring steel, ⅜ to ½ in. in diameter, and about 6 ft. long. Mark it off into three sections, as at A in the drawing, making the marks very light with a center punch, not a cold chisel. Heat one end of the bar and forge it as at F, then heat the bar at the mark D and bend the top over as at B. Now heat at the second mark E and bend the lower part toward the forged end F, but not touching it. True your triangle until the base is horizontal and the other two sides form equal angles at each end of the base. To see if the piece is straight, place it on a perfectly level surface, and if all sides touch equally your job is finished.



Making a Triangle

In working your steel bar be careful not to overheat and burn it, and also not to work too cold. Be sure to have an opening at one corner of the triangle, as shown in the sketch at C.

MOVING HEAVY WEIGHTS IN THE MOUNTAINS.

When nothing else is available the windlass shown in the accompanying sketches is used in the mountains of Montana for moving heavy weights. If it is possible to obtain anything else for the purpose this windlass is not desirable, but it may prove very useful in an emergency.

At the top and base of the windlass are iron bands having rings from which pass strong guy ropes and chains to iron rods driven into the ground. The weight is attached by means of strong rope, which unwinds from the small drum and winds upon the larger, thus giving double or triple purchase according to the difference in size of the two drums (Fig. 1). When the weight has been pulled up as far as the windlass can pull it, the rope No. 2B (Fig. 2) is shortened and the windlass rope lengthened or unwound and a new start is taken, or the windlass is moved farther back. A, Fig. 2, indicates the guy stakes.—Contributed by Lee R. Clarke, Bozeman, Mont.

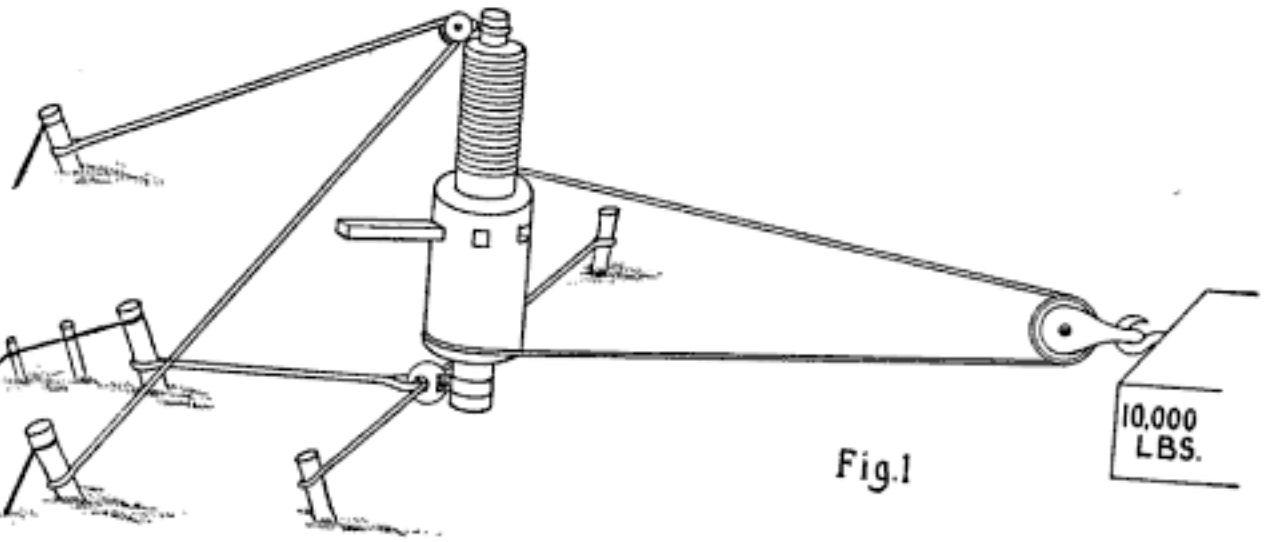


Fig.1

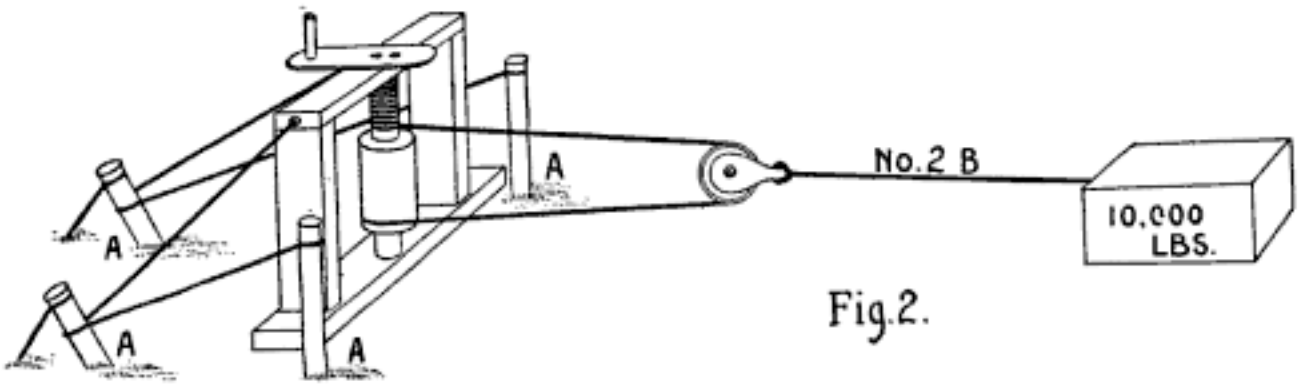


Fig.2.

For laying 100 cu. ft. of wall, a cord of stone, 3 bu. of lime and a cubic yard of sand should be allowed.

CEMENT FOR UNITING BRASS AND GLASS.

One part caustic soda, 3 parts rosin, 3 parts plaster, 5 parts water, boiled together. Hardens in one-half hour. To prevent hardening so rapidly substitute zinc white, white lead, or slaked lime for the plaster.

AUTOMATIC TIRE PUMP FOR AUTOS.

Automobile tires may be inflated while the machine is running. The device is specially recommended for use where a slight puncture is had and it is desirable not to repair before reaching home or some shop. The pump is carried in the tool box and fastens to the hub. An eccentric works the pump, the air steadily discharging into the tire. The pump will fit any make of wheel.

TO REMOVE FROST FROM WINDOWS.

One of the simplest and quickest methods of removing ice from windows is to place common coarse salt on a dry cloth and rub the frost. You will be surprised to see how rapidly the frost is removed, and the glass will not coat again for a day or two, even in very cold weather.

WHERE THE BEST BRISTLES ARE OBTAINED—RUSSIA THE SOURCE OF LARGEST SUPPLY.

Bristles are so extensively used for brushes of so many descriptions and for such widely varied purposes that one wonders where all the abundant supply comes from. Good bristles, however, are expensive and more than that, the American supply is of the lowest grade, short, crooked and fit only for the cheapest kinds of brushes.

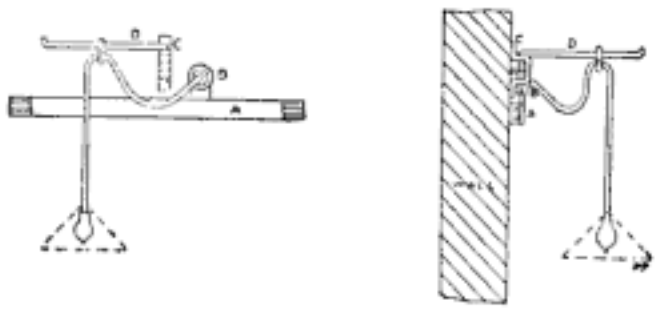
The reason for this is that in America hogs are grown for pork, and are killed young, the bristles being obtained at several of the large American packing plants, where men, hired for the purpose, grab what bristles they can as the hogs pass along in being cleaned, after killing. The bristles are gray and less sightly than the white ones obtained elsewhere. The hair from the ridge of the hog's back is the best and is saved for brushmakers' use; that from the sides is used in cheap grades of curled hair used by upholsterers, says the Master Painter.

Russia supplies the world with the highest grade of bristles, long, stiff and snow white, the latter quality being no inconsiderable factor, though for efficiency it makes them no better than the gray or black bristles. The reason Russia leads in this product is that the hogs from which the bristles are obtained live in the forest, half wild, and are not killed young for pork as in the United States. The better the hog for pork the poorer for bristles. Siberia also produces good bristles. The bristles are packed in casks weighing 250 and 300 pounds. They are assorted into the following grades: "Okataka," from 5 to 7 in. long and used by shoemakers, the coarsest and stiffest bristles grown. "Firsts," 4 to 6 in. long, stiff and elastic; "Suchoys," 4½ to 5 in. long, fine and soft; and "Seconds," 3½ to 6 in. long, also fine and soft. Each grade is furnished in the four colors, white, bronze, gray and black. The peasant women save the bristles and sell them to itinerant peddlars who in turn sell them to dealers. The best stock is gathered in the winter time and they range in price from 60 cents to $5.00 per pound. To be a good bristle buyer requires years of experience. The quality of bristles is determined by length, stiffness and color; cheap qualities are often made to appear far better than they really are.

Germany, France, China and India all furnish bristles in commercial quantities.

ADJUSTABLE LIGHT FOR FITTING BENCHES.

When fitting benches run along the wall they can be lighted up very nicely in the manner shown in the sketch. Lamps suspended from the roof are unhandy, as it is often difficult to fix them in just the right position.



Adjustable Light for the Fitting Bench

To arrange the light as shown run the wiring along the wall about 4 ft. above the benches, as at A, and take them up to the rose, B. A wrought-iron bracket, C, is fixed to the wall by two screws. This bracket is drilled to receive the swing arm, D, which is made out of a ½-in. round arm in the shape shown. A small S hook is hung loose on the arm and the wire passed over it. The loop in the lower part of the S hook, says the Electrical Magazine, London, should be just large enough for the wires to pass through and keep it the required height as adjusted.

HOW TO BRAZE HOLLOW CASTINGS.

Take old wagon or buggy boxing and crack it. Drive a very thin wedge in the crack to keep it from closing tight when hot. Take the softest brass filings or spelter that can be got. Mix it with about one-eighth of its bulk of boric acid. Put the box in the fire and heat red. Dip a point of a lily in the mixture and spread it along the crack; blow up until the brass is melted. Take out and lay it away to cool. Be careful not to jar while hot. Take a sledge and mash up when cold and you will see that you have brazed the easiest thing possible, and for this reason the brass was clean and the work contracted and did not move while heating and cooling, as separate pieces would, which is the secret of the whole job, says a correspondent of the Blacksmith and Wheelwright. If your break is dirty or rusty, file, scrape, saw and brush with muriatic acid. Or if you use common soldering acid in the shop, that is best.

WIRELESS TELEGRAPHY IN EVERY DAY USE.

It is hard for the layman to realize that in a comparatively short time wireless telegraphy has passed from the merely experimental stage to the point where it is giving constant and practical service. Already it has figured importantly in a great conflict and has become an adjunct of every great navy.

Since June, 1902, the Marconi system has been an important part of the equipment of the Belgium mail packets plying between Dover and Ostend. Experiments were begun on these packets in 1900. A coast station having a mast 151 feet high was established at La Panne and the floating station was established on the "Princess Clementine" which had a mast 98 feet high. The transmitter system of each station consisted of an oscillator having one terminal connected to the earth and the other to an antenna. In October, 1901, the tests resulted satisfactorily. Then the government began installing the system.

A new station was established at Nieuport Bains, the building being of brick with the terminal of the antenna carried to it. The mast is in its immediate neighborhood and the station has the ordinary telegraphic communication with the interior of the country. Two government employes are on duty at this station during the day; during the night, one employe of the wireless telegraph company. Each vessel sends an average of three telegrams during a night voyage, and during day trips each vessel receives one message. In the messages, the signal of the message, a number, is first given, then the number of words, the nature of the telegram (service, private, or government), the name of the boat and the text which is usually of the following character: "Left Dover at 11:03 P. M.; thirty-two passengers; 220 postal sacks; clear; wind E. S. E."; signature. The commander and his officers have charge of the manipulation. The steamer stations receive no outside messages nor interfere with any apparatus having a different pitch, the government contracts calling for this syntonizing. Signals are exchanged best on damp moonlight nights.

The transmitting station, says the Electrical Review, consists of a storage battery of eight cells which supply the Ruhmkorff coil with eight amperes at sixteen volts, equivalent to 160 watts. The coil transforms the current to 40,000 volts. The storage battery is charged by the dynamo which lights the station. The antenna consists of three wires soldered together at the extremities. The total length of wire is 180 feet. The height varies on the packets from 49 feet to 89 feet, according to the height of mast.

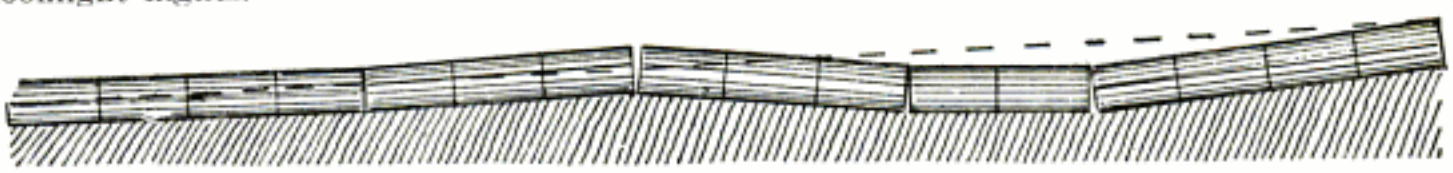
The receiving apparatus consists of a receiver complete: relay, decoherer, coherer, jigger, box of batteries, next a Morse register and a signal bell. Each station is provided also with reserve apparatus, a storage battery, a coil complete, three Leyden jars, a receiver complete, and twelve batteries.

Service in some of the packets is now public, the charge being 10 cents for fifteen words. Wind, rain, snow, cold or heat, the service remains as efficient—and at times has been of great importance. For instance a packet once encountered a Norwegian bark with a broken rudder. The condition of the bark was reported by wireless telegraphy and a tug despatched to its aid. Once a thief was believed to have escaped by way of a packet. Upon being informed while at sea the captain instituted a search for him and made sure he was not on board.

There have been other instances—broken propellers, light buoys going out, danger of losing routes in heavy fogs, etc., all of which have been safely met by this wonderful new agency, which means more to the navigator than to any one else.

DRAINS AMONG TREES.

Tile should not be run among trees, especially willow or cottonwood trees, says Brick. The illustration shows the probable effect on the drain, if this advice is not heeded. The small fibrous roots will soon choke the tiles and entirely shut off the water they are intended to carry, so that it will be necessary to dig them out and clean them. In such case, do not replace them, but run in the same size sewer pipe, cementing the joints to prevent a recurrence of the trouble.



What May Happen to Tile Run Among Trees

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE A WINDMILL OF ONE OR TWO HORSEPOWER FOR PRACTICAL PURPOSES.

A windmill for developing from one-half to two horsepower may be constructed at home, the expense being very small and the results highly satisfactory.

The hub for the revolving fan wheel is first constructed. One good way to get both the hub, lining, shaft and spokes for the blades, is to go to a wheelwright's and purchase the wheel and axle of some old rig. There are always a number of discarded carriages, wagons or parts thereof in the rear of the average blacksmith's shop. Sometimes for half a dollar and often for nothing, you can get a wheel, an axle, and connected parts. Remove from the wheel, all but the four spokes needed for the fans as in Fig. 1. The same hub, axle and bearings will do. In case you cannot secure a wheel and shaft, the hub may be made from a piece of hardwood, about 4 in. in diameter and 6 in. long. A 2-in. hole should be bored through for a wooden shaft, or a 1½-in. hole for a metal shaft. The hub may be secured by putting two or three metal pins through hub and shaft. Adjust the spokes by boring holes for them and arrange them so that they extend from the center A, like B. The wheel is then ready for the blades. These blades should be of sheet metal or thin hardwood. The sizes may vary according to the capacity of the wheel and amount of room for the blades on the spokes. Each one is tilted so as to receive the force of the wind at an angle, which adjustment causes the wheel to revolve when the wind pressure is strong enough. Secure the blades to the spokes by using little metal cleats, C and D. Bend these metal strips to suit the form of the spokes and flatten against the blades and then insert the screws to fasten the cleats to the wood. If sheet metal blades are used, rivets should be used for fastening them.

The stand for the wheel shaft is shown in Fig. 2. Arrange the base piece in platform order, (J). This is more fully shown in Fig. 5. On top of this base piece, which is about 36 in. long, place the seat or ring for the revolving table. The circular seat is indicated at I, Fig. 1. This ring is like an inverted cheese box cover with the center cut out. It can be made by a tinner. Size of ring outside, 35 in. The shoulders are 4 in. high and made of the tin also. Form the shoulder by soldering the piece on. Thus we get a smooth surfacing with sides for the mill base to turn in so as to receive the wind at each point to advantage. The X-shaped piece H rests in the tin rim. The X-form, however, does not

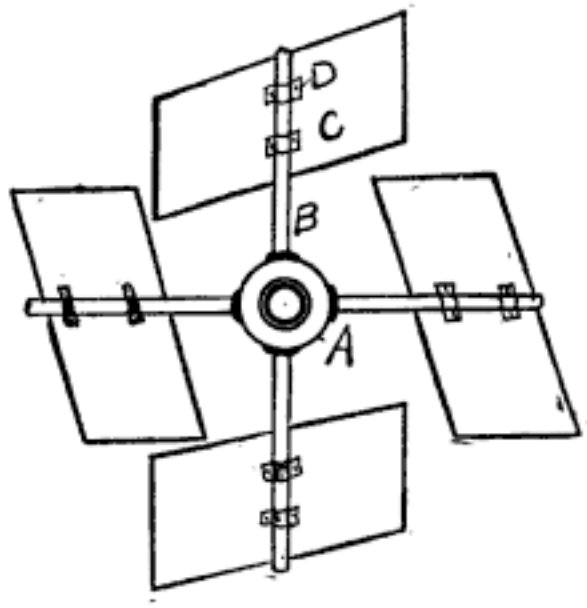


Fig. 1

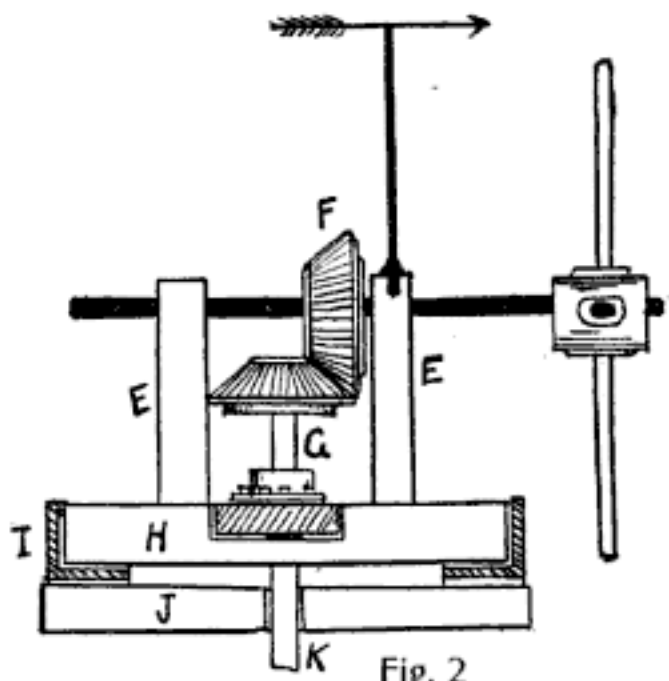


Fig. 2

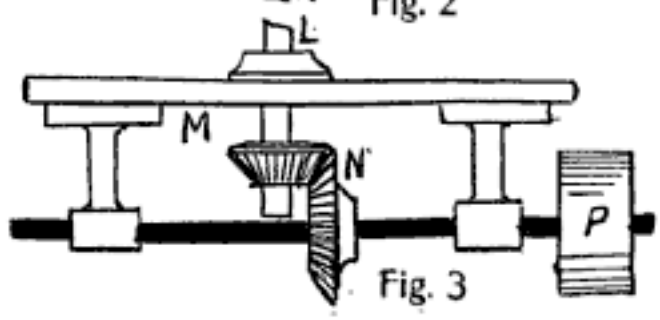


Fig. 3

show in this sketch, but in Fig. 5, where it is marked S. This part is made of two pieces of 2-in. plank, about 3 in. wide, arranged so that the two pieces cross to make a letter X. When the pieces join, mortise them one into the other so as to secure a good joint. Adjust the uprights for sustaining the wheel shaft to the X pieces as shown at E, E, Fig. 2. These are 4x4-in. pieces of wood, hard pine preferred, planed and securely set up in the X-pieces by mortising into the same. Make the bearings for the wheel shaft in the uprights and insert the shaft.

The gearing for the transmission of the power from the wheel shaft to the shaft calculated for the delivery of the power at an accessible point below must next be adjusted. The windmill is intended for installation on top of a building, and the power may be transmitted below, or to the top of a stand specially erected for the purpose. It is a good plan to visit some of the second-hand machinery dealers and get four gears, a pulley and a shaft. Gears about 5 in. in diameter and beveled will be required. Adjust the first pair of the beveled gears as at F and G. If the wheel shaft is metal, the gear may be set-screwed to the shaft, or keyed to it. If the shaft is hardwood, it will be necessary to arrange for a special connection. The shaft may be wrapped with sheet metal and this metal fastened on with screws. Then the gear may be attached by passing a pin through the set-screw hole and through the shaft. The upright shaft like the wheel shaft is best when of metal. This shaft is shown extending from the gear, G, to a point below. The object is to have the shaft reach to the point where the power is received for the service below. The shaft is shown cut off at K. Passing to Fig. 3 the shaft is again taken up at L. It now passes through the arrangement shown, which device is rigged up to hold the shaft and delivery wheel P in place. This shaft should also be metal. Secure the beveled gears M and N as shown. These transmit the power from the upright shaft to the lower horizontal shaft. Provide the wheel or pulley, P, with the necessary belt to carry the power from this shaft to the point of use.

The tail board of the windmill is illustrated in Fig. 4. A good way to make this board is to use a section of thin lumber and attach it to the rear upright, E of Fig. 2. This may be done by boring a hole in the upright and inserting the shaft of the tail-piece. In Fig. 4 is also shown the process

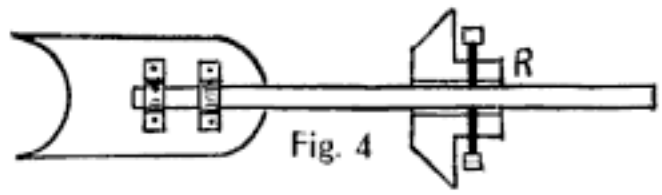


Fig. 4

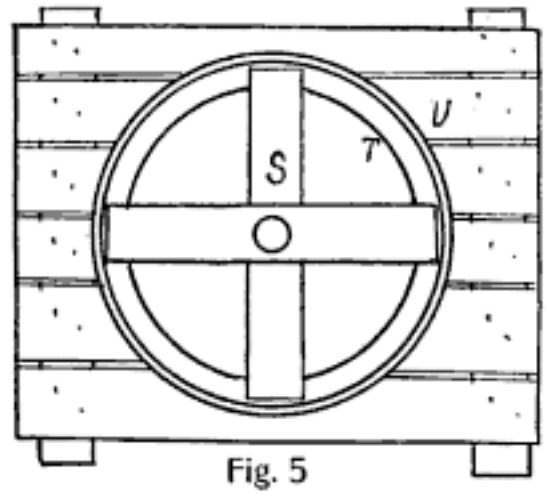


Fig. 5

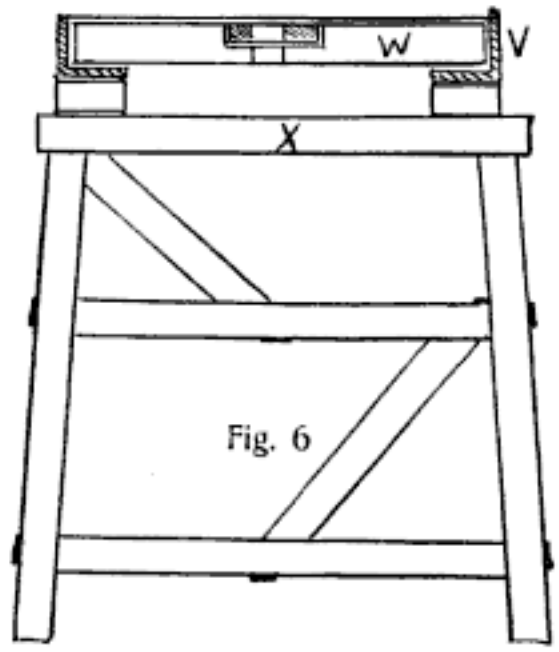


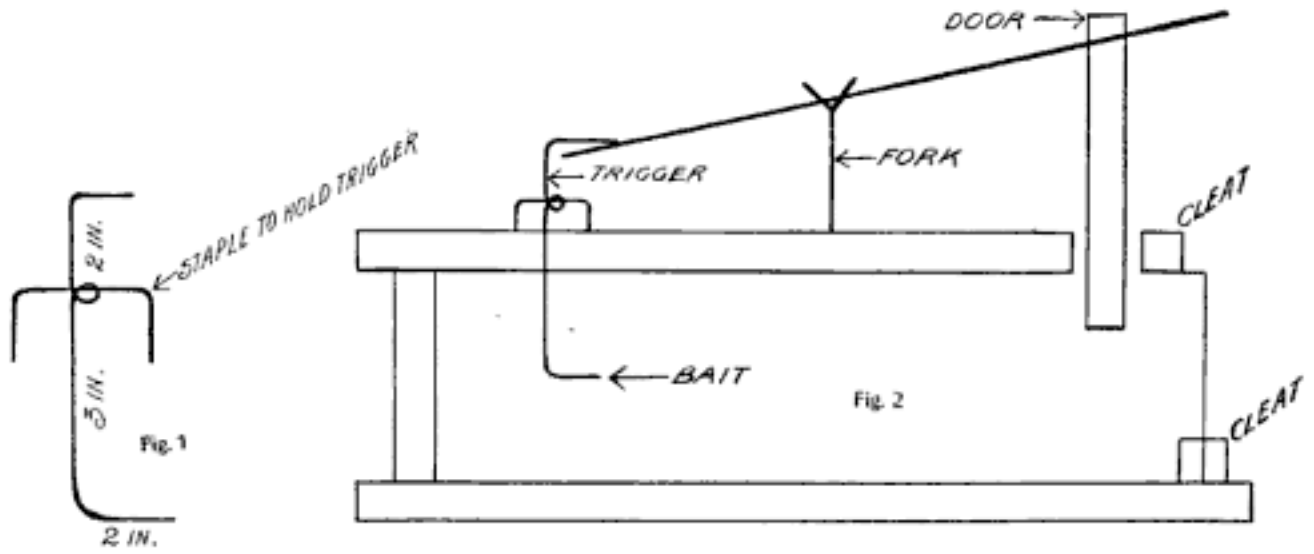
Fig. 6

of fastening a gear, R, to the shaft. The set screws enter the hub from the two sides and the points are pressed upon the shaft, thus holding the gear firmly in place. The platform for the entire wheel device is shown in Fig. 5. The X-piece S is bored through in the middle and the upright shaft passes through. The tin run-way or ring is marked T, and the X-piece very readily revolves in this ring, whenever the wind alters and causes the wheel's position to change. The ring and ring base are secured to the platform, U. The latter is made of boards nailed to the timbers of the staging for supporting the mill. This staging is shown in Fig. 6, in a sectional view. The ring with its X-piece is marked V, the X-piece is marked W, and the base for the part, and the top of the stage is marked X. The stage is made of 2x4-in. stock. The height may

vary, according to the requirements. If the affair is set up on a barn or shed, the staging will be sufficient to support the device. But if the stage is constructed direct from the ground, it will be necessary to use some long timbers to get the wheel up high enough to receive the benefit of the force of the wind. Proceeding on the plan of the derrick stand, as shown in Fig. 6, a stage of considerable height can be obtained.

HOW TO MAKE A TRAP FOR RABBITS, RATS AND MICE.

From an old 6-in. pine fence board cut off four pieces 2½ ft. long and one 6 in. square for the end of the trap and another 4 in. by 8 in. for the door. Use old boards, as new boards scare rabbits.



A Good Rabbit Trap

Fig. 1 shows how the box is made. It should be 4 in. wide and 6 in. high on the inside. The top and bottom boards project 1 in. beyond side boards at the back and end board is set in. The top board should be 2 in. shorter than the sides at the front. Nail a strip on the top board back of door and one on the bottom board so game cannot push the door open from inside the trap and get out.

In the middle of the top board bore a hole and put a crotched stick in for the lever to rest on. Bore another hole in the top of the door for the lever to pass through. Two inches from the back of the box bore a hole for the trigger, which should be made out of heavy wire in the manner shown in Fig. 2. The door of the trap must work easily and loosely.—Contributed by Carl Baum, Valparaiso, Ind.

On June 1st we shall issue in book form the articles printed in "Mechanics for Young America." It will be a gold mine of "Things a Boy Can Do."

HOW TO MAKE A SMALL SEARCHLIGHT.

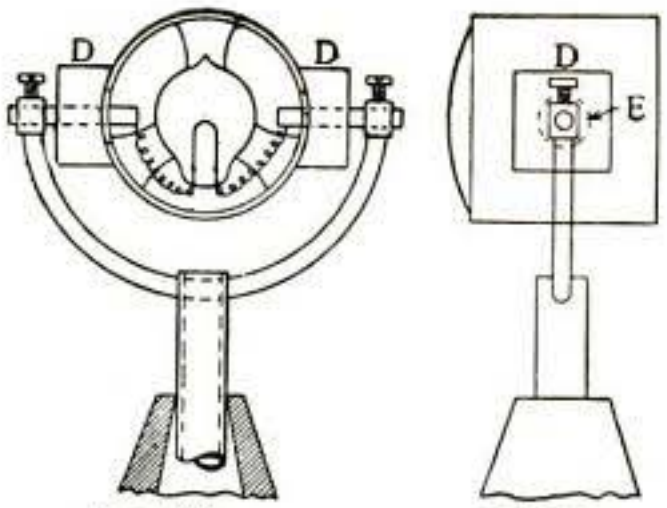
The materials required for a small searchlight are a 4-volt lamp of the loop variety, thin sheet brass for the cylinder, copper piping and brass tubing for base. When completed the searchlight may be fitted to a small boat and will afford a great amount of pleasure for a little work, or it may be put to other uses if desired.

Make a cylinder of wood of the required size and bend a sheet of thin brass around it. Shape small blocks of boxwood, D, Fig. 1, to fit the sides and pass stout pieces of brass wire through the middle of the blocks for trunnions. Exactly through the middle of the sides of the cylinder drill holes just so large that when the blocks containing the trunnions are cemented to the cylinder there is no chance of contact between cylinder and trunnion, and so creating a false circuit.

The trunnion should project slightly into the cylinder, and after the lamp has been placed in position by means of the small wooden blocks shown in Fig. 1, the wires from the lamp should be soldered to the trunnions. It is best to solder the wire to the trunnions before cementing the side blocks inside the cylinder.

Turn a small circle of wood, A, Fig. 2, inside the cylinder to fit exactly and fasten to it a piece of mirror, C, Fig. 2, exactly the same size to serve as a reflector. Painting the wood with white enamel or a piece of brightly polished metal will serve the purpose. On the back of the piece of wood fasten a small brass handle, B, Fig. 2, so that it may readily be removed for cleaning.

In front of cylinder place a piece of magnifying glass for a lens. If a piece to fit cannot be obtained, fit a glass like a linen tester to a small disc of wood or brass to fit the cylinder. If magnifying glass can



Front View Side View.

Fig. 1

not be had, use plain glass and fit them as follows:

Make two rings of brass wire to fit tightly into the cylinder, trace a circle (inside diameter of cylinder) on a piece of cardboard; place cardboard on glass and cut out glass with a glass cutter; break off odd corners with notches on cutters and grind the edge of the glass on an ordinary red brick using plenty of water. Place one brass ring in cylinder then the glass disc and then the other ring.

For the stand fill a piece of copper piping with rosin or lead and melt lead out. Bend the pipe with a piece of curved wood or use some of the many methods of pipe bending which have appeared in the Shop Notes department of Popular Mechanics. Make an incision with a half-round file in the under side of the tube for the wires to come through. Make the base of wood as shown in Fig. 1. One-half inch from the top bore a hole large enough to admit the copper pipe and a larger hole up the center to meet it for the wires to come down.

If it is desired to make the light very complete, says the Model Engineer, London, make the base of two pieces of brass tube,—one being a sliding fit in the other and with projecting pieces to prevent the cylinder from going too far. The light may then be elevated or lowered as wished. On two ordinary brass terminals twist or solder

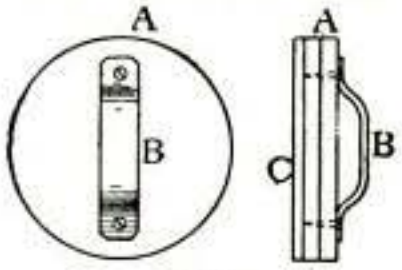


Fig. 2

some flexible wire, but before doing so fix a little bone washer on the screws of the terminal so as to insulate it from the tube. When the wires have been secured to the terminals cover the joint with a piece of very thin india rubber tubing, such as is used for cycle valves. The two wires may now be threaded down the copper tube into the base, and pulled tight, the terminals firmly fixed into the tubes; if too small, some glue will secure them. To get the cylinder into its carriage, put one trunnion into the terminal as far as it will go and this will allow room for the other trunnion to go in its terminal.

FRENCH MOTOR FOR SMALL BOATS.

A French engineer has constructed a portable propelling outfit which one can carry with him, and apply to any small boat he may borrow or rent.

A small gasoline engine furnishes the power, driving a small propeller, which also serves as rudder. The same plan, using an electric motor driven by batteries, was attempted in this country some years ago, but has never been wholly satisfactory.

Any Boat a Motorboat

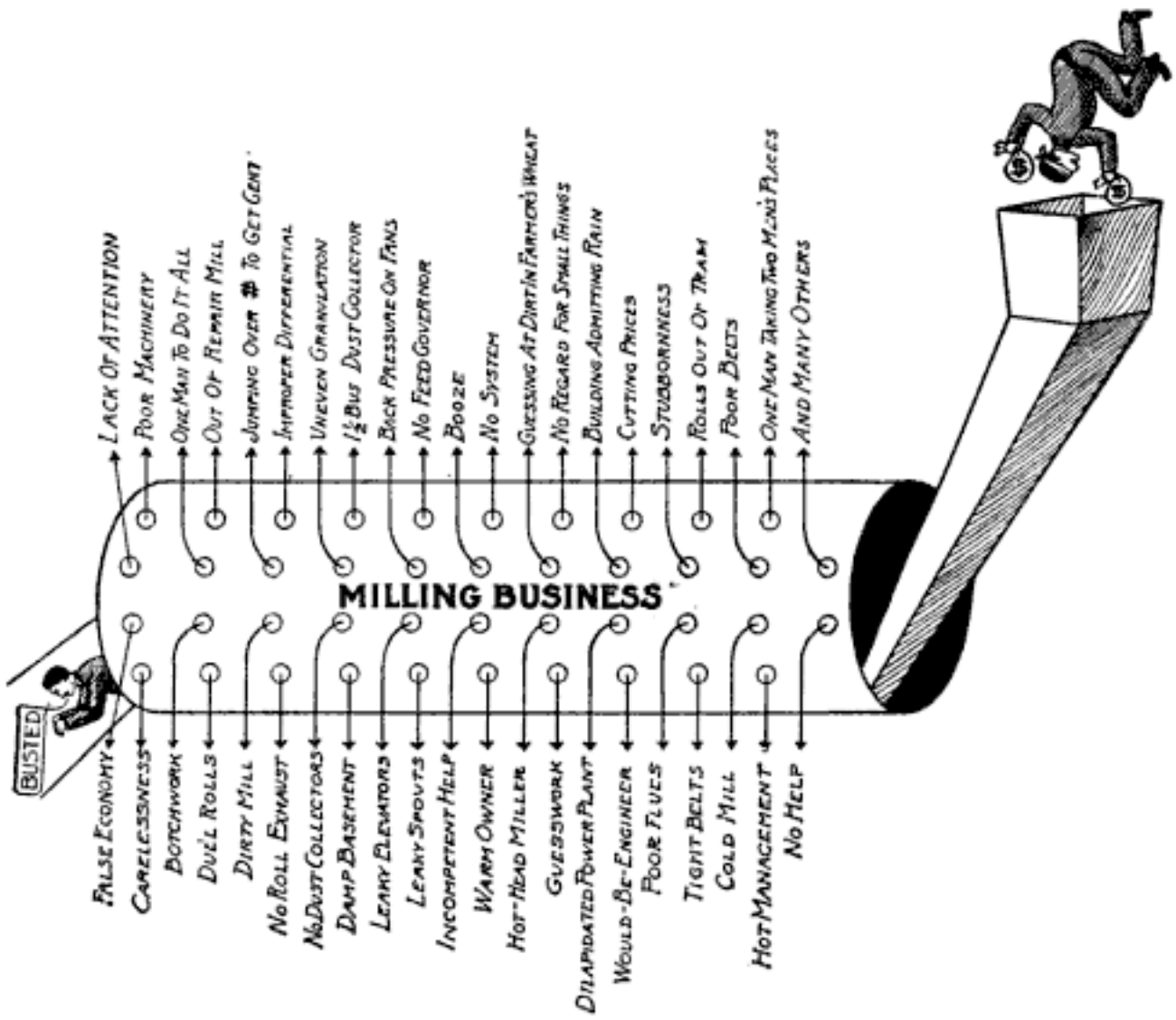
FATIGUE OF METALS.

An army walking over a bridge with steady step would, after a time, break it down. In 1871, Wohler of Germany, tried to find out if metals, like people, become "tired." He used the word "fatigued." Since then many tests and facts have been recorded. Sir Benj. Baker experimented with the steel of the Forth Bridge, England, and in this country Mr. Howard, of the U. S. Testing Bureau, has given the subject much thought.

Before the Pacific Railway Club, Mr. Robert McF. Doble says that iron and steel are more human than commonly supposed. To illustrate, suppose we have three bars of the same kind of steel, each one inch square, and the same length. Let bar No. 1 stand a pull of 30,000 pounds (put on and removed) as many times as it will before breaking. Let the particles of bar No. 2 be crowded together and relieved of a weight of 30,000 pounds until the bar breaks. The weight will be used about the same number of times in each case. Now let bar No. 3 be pulled with a force of 15,000 pounds, and then receive a pressure of 15,000 pounds. It will last only half as long as Nos. 1 and 2.

A piece of wrought iron that broke under one pull of 55,000 pounds stood 210,000 strains of 38,000 pounds. A piece of spring steel required 81,000 pulls of 95,000 pounds to break it, and 1,165,000 strains of 53,000 pounds in a second trial. As a result of these discoveries, the best steel ought to be placed in bridges and structures that carry varying weight, and every piece should be planned so as to keep its load well below its yielding point.

"Going Through the Mill"



Graphic picture of the experience of some who engage in the milling business, but which applies to other lines of manufacture, as well.

The illustration is from the American Miller, which says: "Those that plunge into the milling business blindfolded find many leaks."

Indigestion

I can afford to offer a full dollar's worth free because mine is no ordinary remedy. Ordinary remedies treat symptoms. My remedy treats the causes that produce the symptoms. Symptom treatment must be kept up forever—as long as the cause is there. My treatment may be stopped as soon as it has removed the cause, for that is always the end of trouble.

For stomach trouble is not really a sickness, but a symptom. It is a symptom that a certain set of nerves is ailing. Not the voluntary nerves that enable you to walk and talk and act—but the automatic stomach nerves over which your mind has no control.

What ails the stomach nerves? Worry, probably. Mental anguish destroys their tiny fibers and tears down the telegraph lines without which the stomach has no more self control than a sponge. Over work will do it. Irregular habits will do it.

Overeating will do it. Dissipation will do it. But the effect is the same—stomach failure. I have not room here to explain how these tender, tiny, nerves control and operate the stomach. How worry breaks them down and causes indigestion. How misuse wears them out and causes dyspepsia. How neglect may bring on kidney, heart, and other troubles through sympathy. I have not room to explain how these nerves may be reached and strengthened and vitalized and made well by a remedy I spent thirty years in perfecting—now known by Druggists everywhere as Dr. Shoop's Restorative. I have not room to explain how this remedy, by removing the cause, puts a certain end to indigestion, belching, heartburn, insomnia, nervousness, dyspepsia. All of these things are fully explained in the book I will send when you write.

No matter how these nerves became impaired—I know the way to rebuild their strength—to restore their vigor. For my remedy has stood the test for more than a quarter century. It is now in daily use in more than fifty thousand communities—in more than a million homes—in the United States.

It has cured stomach troubles not once, but repeatedy—over and over again. Yet you may not have heard of it—or hearing, may have delayed or doubted.

My Free Dollar Offer

Any sick one who has not tried my remedy may have a Full Dollar's Worth Free. I ask no deposit, no reference, no security. There is nothing to pay, either now or later. I will send you an order on your druggist which he will accept in full payment for a regular, standard size Dollar bottle. And he will send the bill to me.

C. I. Shoop, M. D.

So I make this offer to you, a stranger, that every possible excuse for doubt may be removed. Send me no money—make me no promise—take no risk. Simply write and ask. If you have not tried my remedy, I will send you an order on your druggist for a full dollar bottle—not a sample, but the regular standard bottle he keeps constantly on his shelves. The druggist will require no conditions. He will accept my order as cheerfully as though your dollar laid before him. He will send the bill to me.

Will you accept this opportunity to learn at my expense absolutely, how to be rid forever of all forms of stomach trouble—to be rid not only of the trouble, but of the very cause which produced it? Write today.

For a free order for a full dollar bottle you must address Dr. Shoop, Box 6353 Racine, Wis. State which book you want.

Book 1 on Dyspepsia.
Book 2 on the Heart.
Book 3 on the Kidneys.
Book 4 for Women.
Book 5 for Men.
Book 6 on Rheumatism.

Mild cases are often cured by a single bottle. For sale at forty thousand drug stores.

Dr. Shoop's Restorative

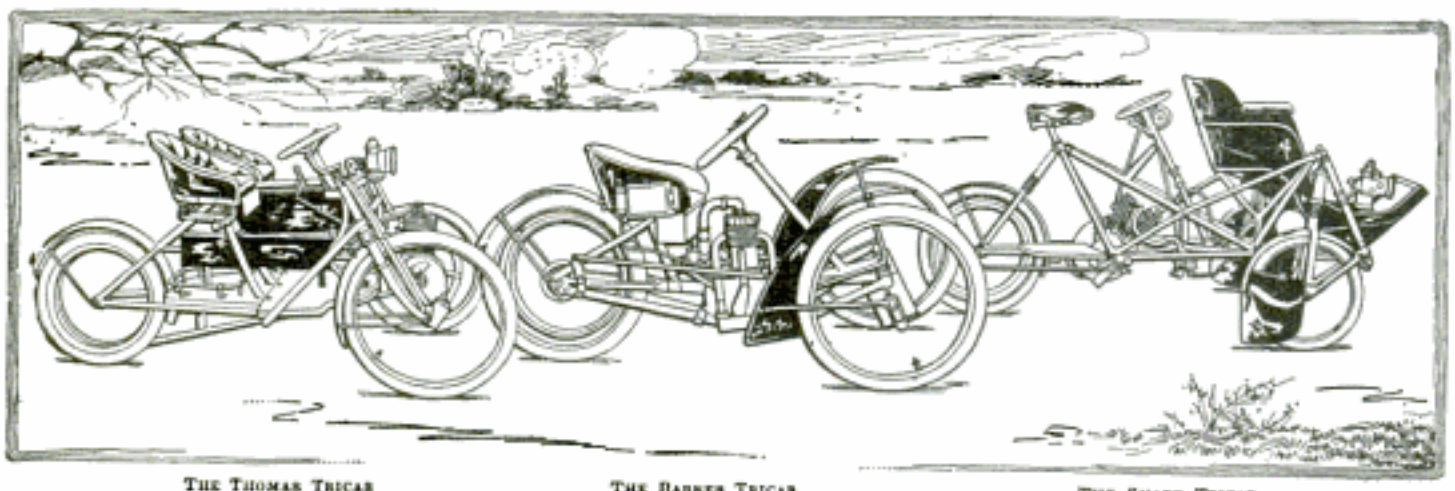
HOW SMITH'S FRIEND GOT THROUGH.

They were out in Kansas about 100 miles and wanted to reach Kansas City. One of them had a pass for John Smith and wife. He was John Smith all right, but his friend could hardly pass for Mrs. Smith. Although they were practically without funds, they boarded the train. "Take a seat in the rear of the car," Smith said to his friend.

Then Smith went forward and sat down by a young woman. Soon they were talking like old friends, and the subject of tickets was brought up by Smith. He asked her to let him see her ticket. It was not of the variety that requires the signature of the purchaser.

Smith examined it until the conductor came through and then he handed up his pass and the ticket. Pointing to his friend behind, he said, "This extra ticket is for him." The scheme worked. To this day the young woman does not know that she was once Mrs. Smith during a short ride through Kansas.—Kansas City Times.

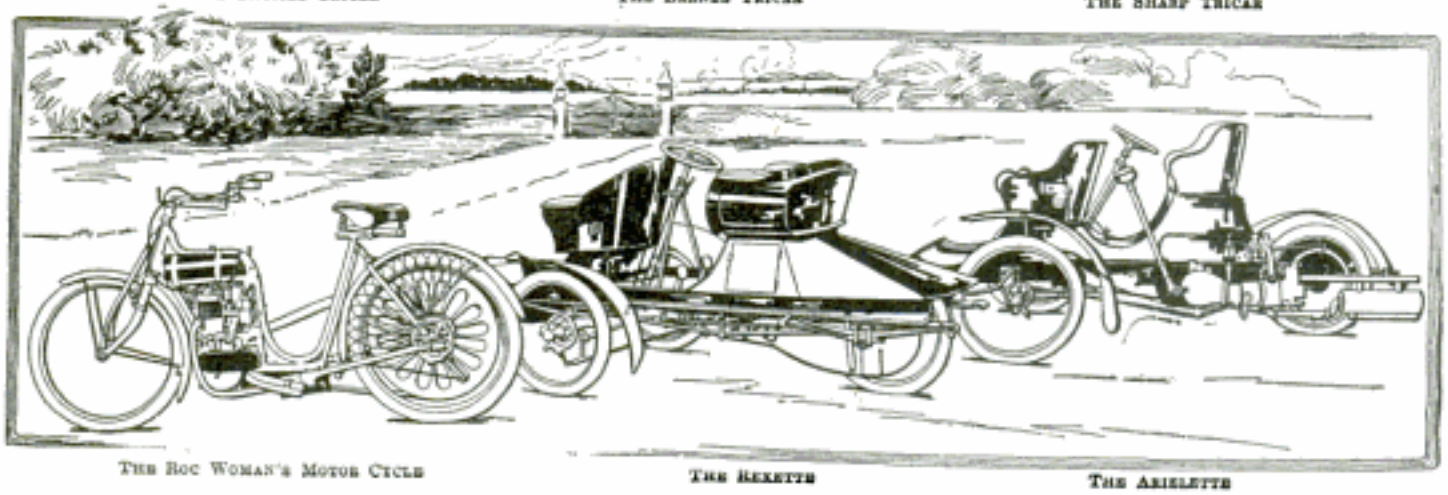
Latest Types English Motorcycles



The Thomas Tricar

The Barnes Tricar

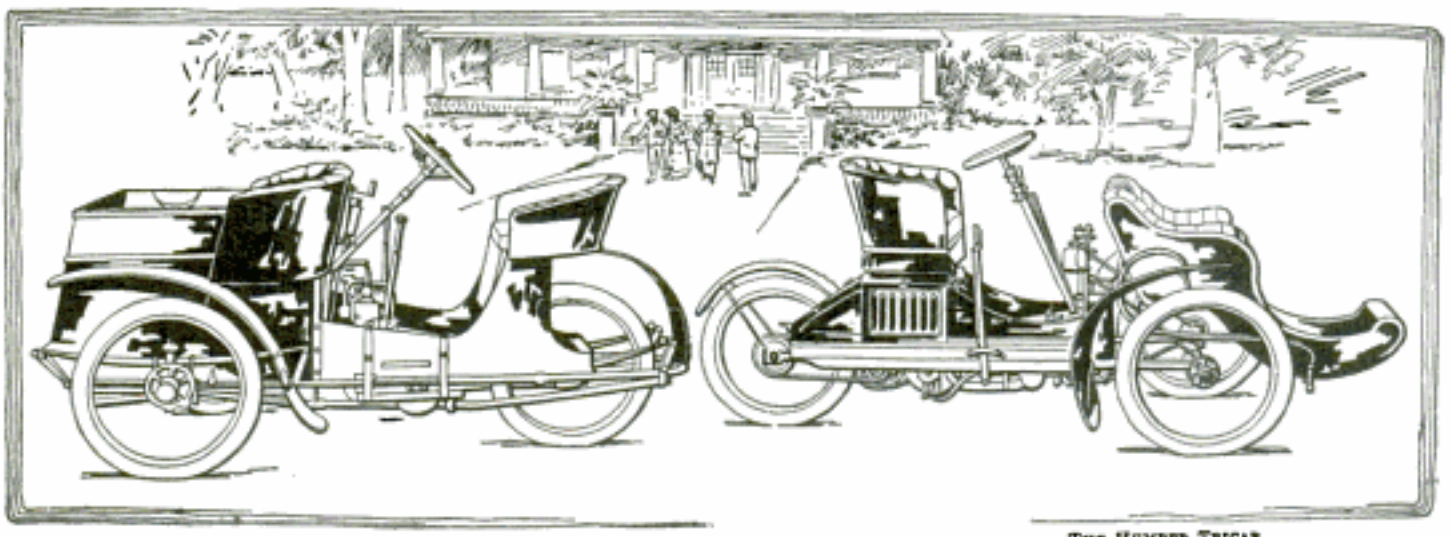
The Sharp Tricar



The Roc Woman's Motor Cycle

The Rexette

The Arieletta



The Bat Tricar.

The Humber Tricar

Courtesy Motor Age

MOLASSES FOR LOCOMOTIVE FEED WATER.

A curious accident happened recently on the Baltimore & Ohio R. R. at Freeport, W. Va. A gang of Italians while emptying big tanks of water from a water train into a tank, got a tank of molasses mixed with the water, and the fact was not discovered till half the engines had taken their supply. The reporter is authority for the statement that "the heat literally made taffy in the boilers and the engines affected were tied up in the yards until their boilers could be scraped out."

A GAS METER DEVICE THAT MAKES CHANGE.

Prepayment gas meters, or those into which small coins are dropped in payment for gas, are much used in England, and require frequent visits from the collector to keep the coin boxes empty. A clever

Gas Meter That Makes Change

device shown attached to a gas meter has been recently brought out.

When a penny is used in the gas meter it falls into the change-giving attachment and is recorded upon a dial. When the dial shows that six pennies are in the box (but not before) a six-penny piece can be inserted in the slot under the lever provided, and the ring near it pulled forward. The six coppers will be returned to the consumer and the six-penny coin will fall into the locked-up box at the bottom. The ring must then be pushed back and the machine is ready to repeat the operation. After the dial records that six coppers are in the box a seventh and an eighth may be used for obtaining gas, but it is necessary that six of them be relieved by a sixpence before any more gas can be obtained. This arrangement might, of course, be applied to coins of any denomination.

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If feasting, RISE before I turn away." It is the hour of FATE 'Tis

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Of many books there's ONE YOU NEED
'Tis unpretentious, and its name?

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That's what most mortals need and if thy needs are common with the rest, **here** is the mystic key to **fortune, fame and joy.**
'Tis FREE, for fortune's smiles can ne'er be bought. Thousands have read and quickly grasped the offered boon. **'Tis now thy turn**—this call the **last to you.** If heeded not you'll seek in vain for that which will return no more. Send thou a postal card and we will tell thee all.

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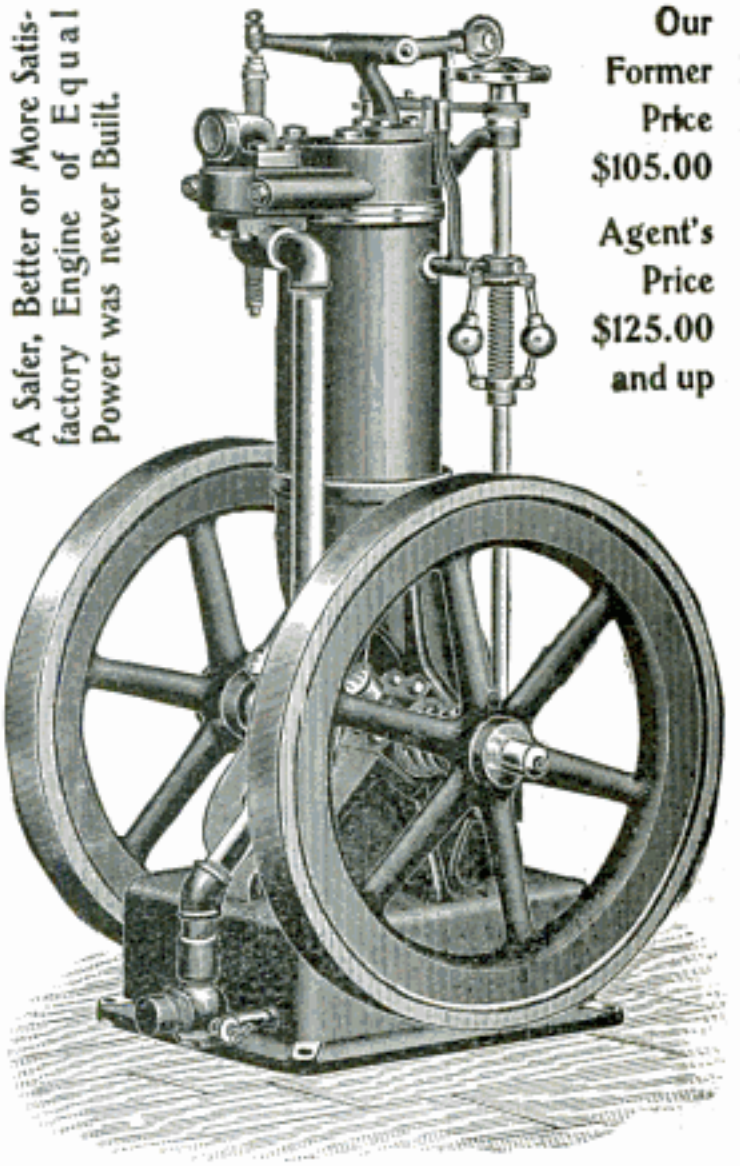

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until you have fully investigated the merits of this excellent "Little Giant." We can satisfy you at a saving of one-quarter. WRITE TODAY FOR ENGINE CATALOGUE. Sent gratis.

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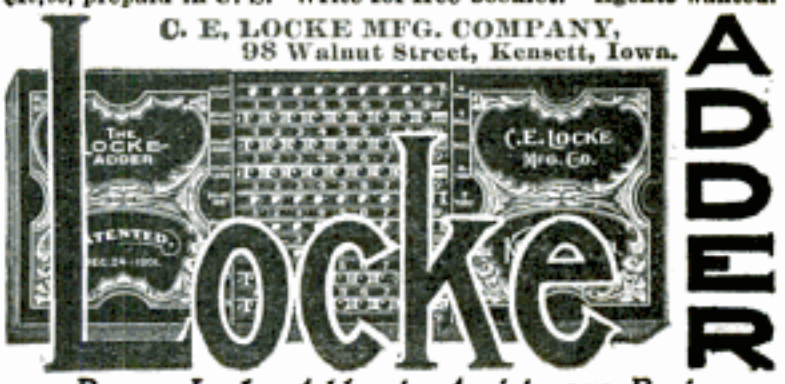


Buy a Locke Adder to Assist your Brain.

IN THE SPRING.

In the spring the young man's fancy lightly turns
to thoughts of trout,
And he hies him to the closet, and he gets his tackle
out;
And he polishes the nickel, and he sharpens up his
hooks,
While his mind it goes cavorting off to sunny, babbling brooks.

Full a week he spends in fixing all his tackle up
with care,
While his step it grows elastic, and his manner
debonair;
Extra flies and lines and leaders, extra fittings he
must get,
Till he drops a hard-earned tenner, but without the
least regret.

For 'tis spring, and trout are heading for the lashing, lapping falls,
And the youth in fancy sees them leaping on the
office walls;
And 'tis lucky thus he sees them in his vision day
by day,
For we know, alas! he cannot see them any other
way.

ELECTRICITY FOR WHITENING BREAD

Every one likes to see fine white loaves of bread, even though it is a known fact that the core of the wheat grain which makes the whitest flour is the least nutritious, as it contains but a small amount of albumen.

In Paris, where the whitest bread is most in demand by the public, it has been attempted to bleach the flour by bringing it in contact with electrified air, the ozone of which effected the bleaching. R. M. Bartleman, our consul at Seville, Spain, says the flour was indeed much whiter, but that its taste and odor were much inferior to the flour whitened in the ordinary manner. The fatty substances in the electrically treated flour were rendered rancid, glutinous and less yellow in color and became oxidized and partly converted into white sebacic acid, which could be dissolved in alcohol; while the glutinuous substances were discolored and changed. The bread made from this flour was decidedly inferior.

A botanist, residing at Santa Rosa, Cal., has produced what he calls an "everlasting flower," which keeps its beauty and fragrance for months after being plucked. A bouquet of these flowers, claimed to have been gathered from his garden a year ago, is in the botanist's library. The stems are somewhat dried, but the flowers in form and color are quite the same. No water is used to keep them.

A FEAT IN HYDRAULICS.

One of the funniest incidents that ever came under my notice happened in an Iowa town, which, with the mill and mill owner, may as well be nameless in this connection, says a correspondent of the American Miller.

The river had been very high and the flood wood came down in large quantities. It happened that some large pieces of wood got into the wheel, and the mill could not be stopped until the head gates were shut down. The tail water stood three feet above the top of the wheel, and under the condition of the water they could not get to the wheel to remove the obstruction.

So the proprietor proposed to the head miller to make a cofferdam around the wheel and set men to pumping the water out of the cofferdam so as to dry up the wheel pit and permit the wheel to be reached in a clear field.

So the cofferdam was built and six men were set to pumping, three at a time in three-hour shifts. They worked all night and did not make any impression on the wheel pit. At six o'clock in the morning the proprietor came down and looked in the pit. "Oh!" he exclaimed, and threw up his hands. "What a dod-gasted fool I am! Stop pumping, boys, stop!"

He had been trying to pump the river up through the wheel.

BOOK REVIEWS

CYCLOPEDIA OF APPLIED ELECTRICITY. Five volumes. Size of page, 8x10 in.; 2,500 pages, 3,000 illustrations. Fully indexed. Bound in ¾ morocco leather. List price, $30.00; special introductory price, $18.00. American School of Correspondence at the Armour Institute of Technology, Chicago.

This comprehensive work on electricity and its practical applications has been prepared by eminent specialists, among them being Prof. F. B. Crocker, of Columbia University; Prof. William Esty, of Lehigh University; Prof. D. C. Jackson, collaborating with Prof. George C. Shaad, of the University of Michigan, and is addressed particularly to the thousands of practical workers in the electrical field whose technical education is limited. For this reason, higher mathematics have been avoided and the subject matter is explained in simple language in connection with a large number of diagrams, specially prepared. The work is also designed as a practical guide for electricians, engineers, telephone and telegraph operators and all others interested in electricity in its practical applications. The subject matter is divided into chapters, or sections, with a view to using the work as a text book, and closely related subjects are brought together under general headings. Many practical examples are given and each volume is supplemented with a list of review questions. The work will be valued by many for reference purposes, also.

CRUSHED STONE AND ITS USES. Compiled by W. J. Jackman. Cloth; 110 pages; illustrated. The Producers Supply Company, Chicago.

The uses to which crushed stone is put have increased greatly within the past few years and a book comprising facts of importance in connection with modern concrete construction cannot fail to be of interest to many. The illustrations add much to the interest in the book.

AMERICAN TOOL MAKING AND INTERCHANGEABLE MANUFACTURING. By Joseph V. Woodworth; 560 pages; 600 illustrations. Cloth. Price, $4.00. The Norman W. Henley Publishing Co. New York.

The art of American tool-making and system of interchangeable manufacturing as carried on in the United States today is treated in this volume in a thorough and practical manner. Each tool is described and illustrated in such a way that any practical man could design, construct and use special tools, dies and fixtures for the rapid and accurate production of metal parts, interchangeably, and every tool described has been used for the actual production of work. The book also contains many valuable hints pertaining to the subject it treats.

ELECTRICAL CIRCUITS AND DIAGARMS. Illustrated and Explained. By Norman H. Schneider. Paper covers, 25 cents. Spon & Chamberlain. New York.

This inexpensive and valuable little book will just fit the needs of many a man and boy interested in Electricity. It gives a great deal of information in concise form, containing among others, original drawings of alarms, annunciators, automobiles, bells, dynamos, gas lighting motors, storage batteries, telephone, telegraph, wireless telegraphy, wiring and testing, etc.

SUCTION GAS. By Oscar H. Haenssgen. 100 pages; illustrated. Cloth, $1.00. The Gas Engine Publishing Co. Cincinnati.

The manufacture of gas suitable for power service is a matter of growing importance. For small and medium sized units the suction gas producer has attracted considerable attention, and a book supplying full information on the subject is very timely. The book treats the subject in a simple, yet thorough manner and is well worth the attention of those interested in suction gas producers.

THE VALVE WORLD. Published monthly by the Crane Co., Chicago. The first issue of this publication appeared on January 16th—a trade paper full of interesting and fresh matter pertinent to its field. The initial number contains an appropriate article giving the history of the Crane company from its start in 1855 to the present time. The object of the publication as stated is to bring to the attention of customers and trade generally the many new ideas continually arising in the valve line.

ELEMENTARY COURSE IN MECHANICAL DRAWING. Part I. (Part II in preparation). By Arthur W. Chase, B. S. 7x9 oblong; 189 pages, 97 figures. Cloth, $1.50. Howland Speakman, Chicago.

A course in elementary drawing presented in a simple style, free from technical language and comprising selection and use of Instruments, Geometrical Problems and Orthographic Projections. Superfluous features are eliminated and the book gives the pupil such drill as he would probably experience in practical work.

DRY BATTERIES; HOW TO MAKE AND USE THEM. By Norman H. Schneider. Illustrated. Paper covers, 25 cents. Spon & Chamberlain. New York.

The dry battery is put to so many purposes nowadays that information concerning their construction and use is continually in demand. This little book gives detailed instruction for the manufacture of dry cells of any shape and size, especially adapted for automobiles, launches and gas engine works, medical coils, bells, burglar alarms and many other purposes.

THE STUDY OF ELECTRICITY FOR BEGINNERS. By Norman H. Schneider. 100 pages; 54 illustrations and six tables. Paper covers, 25 cents. Spon & Chamberlain. New York.

This work is especially compiled for beginners and treats of the elements of electricity and magnetism as applied to dynamos, motors, wiring and to all branches of electrical work.

HANDBOOK ON ENGINEERING. By Henry C. Tulley. Second edition, revised and enlarged; 827 pages; 325 illustrations. Price, $3.50. Henry C. Tulley & Co., St. Louis, Mo.

This is practically a non-technical text book and reference book on engineering. Beginning with the simple facts it proceeds, step by step, to the abstract principles in such a plain instructive manner, that knowledge of the subject is acquired without great mental effort. Electricity and its general phenomena is explained and described in over 200 pages, and that without a single word which is not plain and simple. The aim of the book is both to make the engineer skilled and to increase his information so that he can have the advantage of appearing well informed without sham or pretense. It covers all branches of mechanical engineering, and also contains a large number of valuable tables and solutions of knotty problems likely to arise in daily practice.

CONVERT RADISHES INTO POTATOES.

A process for transforming radishes into potatoes has been invented by Monsieur Molliard of Paris, writes Frank W. Mahin, United States consul at Birmingham, England.

The inventor takes a very young radish and cultivates it in a glass retort, in a concentrated solution of glucose. This develops considerable starch in the cells of the radish, and it swells out, loses its pepperiness, and gradually acquires the flavor, consistency and nutritive properties of the potato.

It is not practicable to cultivate potatoes in this manner, when they are grown so cheaply in the ordinary way, but the process may lead to important developments.

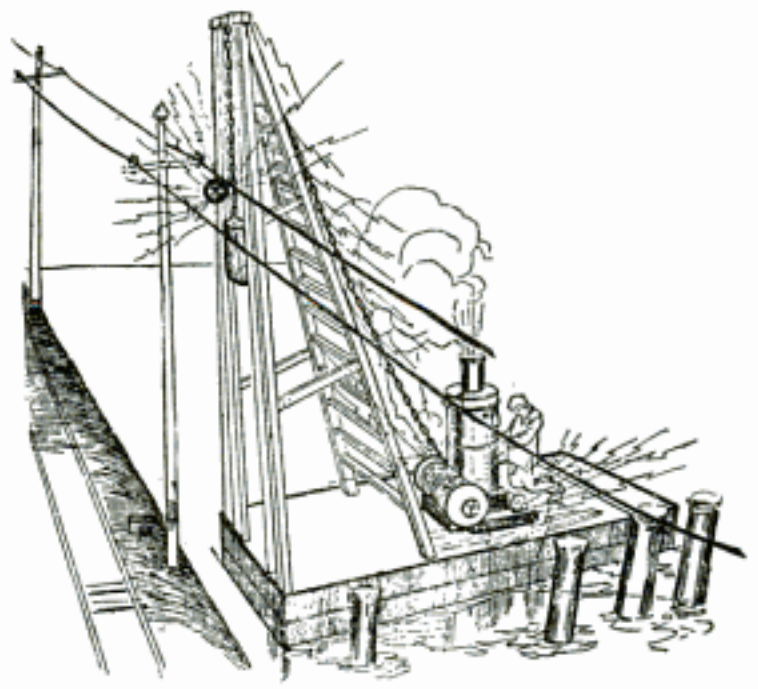
SHIP RATED A1 AFTER FORTY YEARS IN SEA.

A wooden war vessel which had rested at the bottom of Portsmouth harbor for forty years was fished up two years ago, refitted and relaunched under an A1 rating for 16 years. The vessel was built by the United States in 1862, of the best live oak obtainable at the time, but was sunk soon after launching. After forty years in the sea the framing was in remarkably good condition. The ship was painted and relaunched as a 4-masted schooner under the name of "Mary L. Newhall."

California has 100,000,000 acres, one-third of which can be irrigated, claims Governor George C. Pardee, who believes that future years will see a population of 25,000,000 people for the 30,000,000 irrigated acres.

PILE-DRIVER CHAIN CARRIED ELECTROCUTING CURRENT.

A 30,000 volt electric current was grounded by the chain of a pile-driver coming in contact with the main wire of an Oakland, Cal., power company a few days ago, and passing along the chain to the engine below, against which the engineer chanced to be leaning, accomplished a remarkable instance of accidental electrocution. The engineer was instantly killed and his assistant was badly stunned.



Manner in Which The Current was Grounded and Engineer Electrocuted.

The pile-driver, which was being used in the construction of a bulkhead out into the main estuary, was being towed on a barge close to the bank so that the piles might be driven close in, when the chain came in contact with the wires. In an instant there was a blinding flash as the strong current sped to its deadly task, and the engineer fell to the floor of the barge.

The assistant, who was only stunned, in describing his sensations afterward, said: "It seemed to me as though I had been hit with a club, and at the same time my flesh seemed to burn as though a thousand needles were piercing me at every point. I must have become unconscious then, as I can remember nothing further."

At the close of this year all the articles appearing in our "Shop Notes" department will be reprinted in book form. The "Shop Notes for 1905," which contains 200 pages and 385 illustrations, is now ready for mailing. Price, 50 cents, postpaid.

DEADLY WORMS IN GERMAN COAL MINES.

The ravages of the miner's worm is causing great suffering in several mining districts of Germany, in Westphalia 60 per cent of the miners being affected.

The worm, which is about .197 inch in length and its ovum about .0394 inch, is believed to enter the system through the mouth or open wound, and fastens itself in the mucous membrane of the duodenum and produces an anæmia so pronounced as to wreck the infected person's health. It is not fatal and is treated with male fern tree or its oil, says United States Consul Brundage, Aix la Chapelle, Germany.

The great trouble is that it is extremely difficult to eradicate them from a mine, once it is infected, as dampness and slime is favorable to the worms, and sulphuric water and gases do not affect them. In many districts each miner changes his clothes on going to work and bathes on returning from the mine. During the night his clothes are fumigated.

LONGEST CANTILEVER BRIDGE.

There is now under construction across the St. Lawrence river at Quebec a cantilever bridge which, when completed, will contain the longest span of any bridge yet erected, not even excluding the great cantilevers on the Forth bridge in Scotland. The structure is of the cantilever type, and consists of two approach spans of 210 feet each, two shore arms, each 500 feet in length, and a great central span, 1,800 feet in length. The total length of the bridge is 4,220 feet, and, although in extreme dimensions it does not compare with the Frith of Forth bridge, which is about one mile in total length, it has the distinction of having the longest span in the world by 90 feet, two cantilevers of the Forth bridge being each 1,700 feet in length.

The total width of the floor is 80 feet, and provision is made for a double track railway, two roadways for vehicles, and two sidewalks.

In a cantilever of this magnitude the individual members are necessarily of huge proportions, the main posts, for instance, being 325 feet in length, and each weighing 750 tons.

STREET CAR HOUSES.

A summer suburb of Revere, Mass., is built up entirely of old horse-cars transformed into cottages. The transportation company sold the cars at $10 each and the cheerful buyers arranged them in regular street formation, built on piazzas in front and kitchens behind, and christened the place Streetcarville.

If a man has an eight gallon can full of milk and a woman has one five and one three-gallon can (both empty), how is the man going to sell the woman four gallons of milk and accurately measure the same in the cans on hand?

A North Dakota farmer who had been selling his wheat for 68 cents, cleaned one load and got 90 cents, and was offered 60 cents for the screenings. With the 22 cents thus saved he found himself able to buy a bushel of oats; so that the intelligent use of the fanning mill gave him a crop of oats equal to his crop of wheat.

CHIROPODISTS TO CARE FOR SOLDIERS' FEET.

In the German army the care of the soldiers' feet is given an important place. Every German infantry regiment has its chiropodist, as a prominent military attache declares that in time all infantry regiments will have.

A foot soldier with sore feet cannot march well, nor can he on occasion advance or retreat fast. The feet need scientific attention just as any part of the military equipment requires it. The soldier must know how to properly use his feet for a 15 or 20 mile march. The shoes and stockings must fit well so that corns and blisters do not form.

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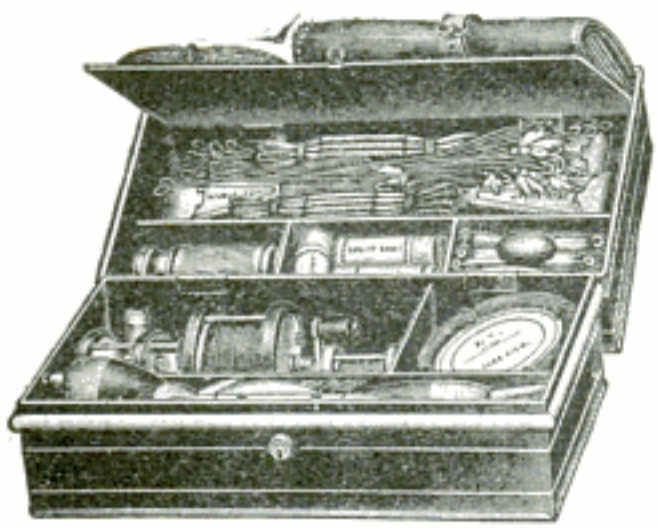
New Mechanical Novelties

TRAYLESS TACKLE BOX—Holds complete outfit for the fisherman. The box opens flat from



Tackle Box

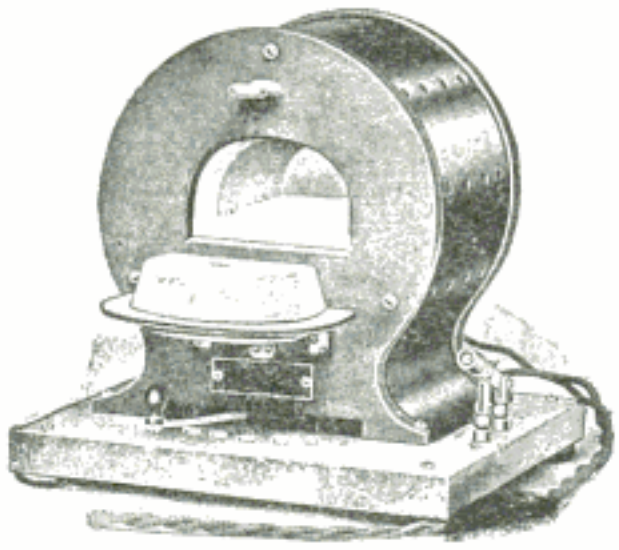
the center like a dress suit case. Size of each half, 11 by 5½ by 2 in. Illustration shows manner of packing contents.

AUTO HORN—An automobile horn in which the plunger for compressing the air is worked by the

Foot Horn

foot, leaving the hands entirely free. The plunger returns to position by a spring which permits rapid and almost continuous blasts on the horn.

ELECTRIC FURNACE—For manufacturing jewelers, assayers, chemists and tempering or hardening small tools. Heats up to 2,800 degrees, but rests on desk or table without heating the wood. Outside measurement, about 6 by 8 by 8 inches. Uses electricity from ordinary lamp socket. Controller gives six graduations of heat, which can



Electric Furnace

be raised or lowered at will. Muffle door allows unobstructed view of interior at all times. Works on any voltage of current from 52 to 500 volts. Heat is absolutely maintained for indefinite period. Specially recommended for "high-speed" steel work. No dust, no noise, no odor. Fills all requirements for enameling.

CANTEEN FILTER—This canteen is about the size of the ordinary hunter's canteen, but contains a cylinder made of Tripoli stone through which the

Sportsman's Canteen

water filters. Of special value to sportsmen, explorers and surveyors who would otherwise be compelled often to drink impure and unsafe water.

LINENOID—This is a tough, hard substance rolled out in boards or moulded into any desired shape. It is made from linen threads reduced to pulp, chemically treated, and subjected to great pressure and heat. Such articles as canoes, trunks, megaphones, boxes and seamless articles are made from it, and are light and strong.

SOMNOFORM—A new anaesthetic whose effects begin and disappear in from 30 to 90 seconds. It originated in Europe and is being experimented with successfully by the Dental Department, University of Michigan.

TWINE CUTTER—This little device is worn on the hand like a ring. By the use of this device cord, from thin twine up to heavy marline, can be cut easily in one brief motion, thus obviating the sore fingers which come through snapping twine

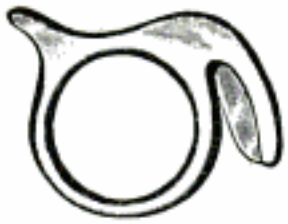


Fig. 1.—The Ring Cutter.

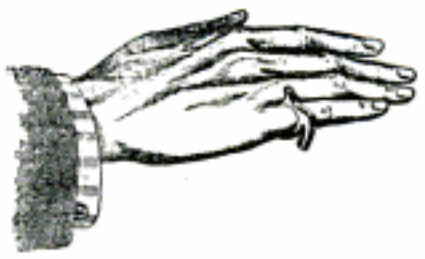
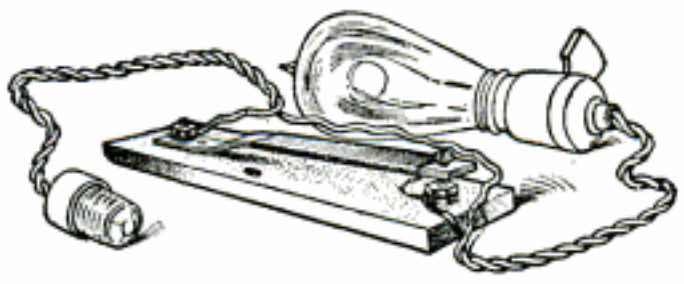


Fig. 2.—As Used.

on parcels. When a package or bundle is tied the end of the twine is caught between the knife edge and the outer surface of the ring proper, and by a slight movement of the hand the twine is instantly cut.

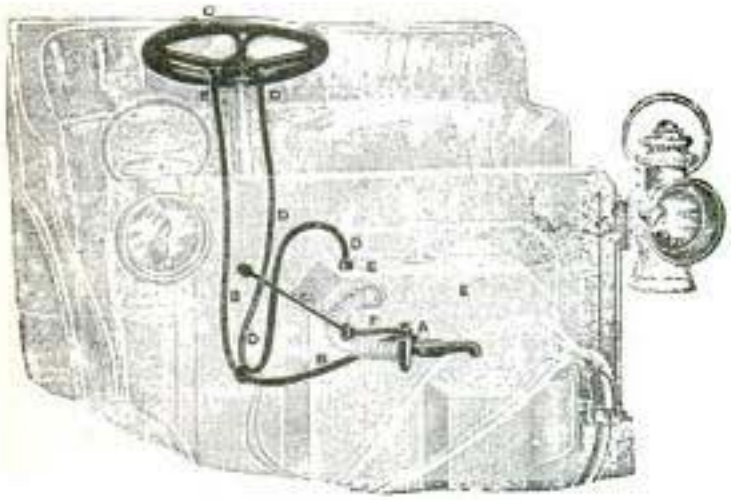
LAMP FLASHER—An automatic, inexpensive device for flashing a number of ordinary electric lamps. Used for electric sign and advertising purposes. A fine wire coil resists the current to such an extent that the lamps do not glow, although a slight amount of electricity is still passing. This resistance in the coil creates heat, which causes the metal strips to expand lengthwise, but being riveted together and the top piece expanding most



Lamp Flasher.

the motion is of necessity downward, thereby causing the connection to be made between the screw in the free end with the binding post below. The effect of this is to short-circuit the coil, cutting out all resistance, and the current passes through the metal strips, lighting the lamps. There is now no more current passing through the coil, so it begins to cool, the metal contracts and the connection is soon broken, so the lamps go out. This process repeats at regular and frequent intervals.

WARM STEERING WHEELS—An English invention affords a warm steering wheel for automobiles. The wheel is made hollow and a circuit of warm water, heated by the exhaust, is kept constantly circulating through the wheel by means of two flexible tubes, shown at B and D in the cut. The water may be taken direct from the water jacket on motors which are water cooled, and the flow regulated by opening and closing a cock.



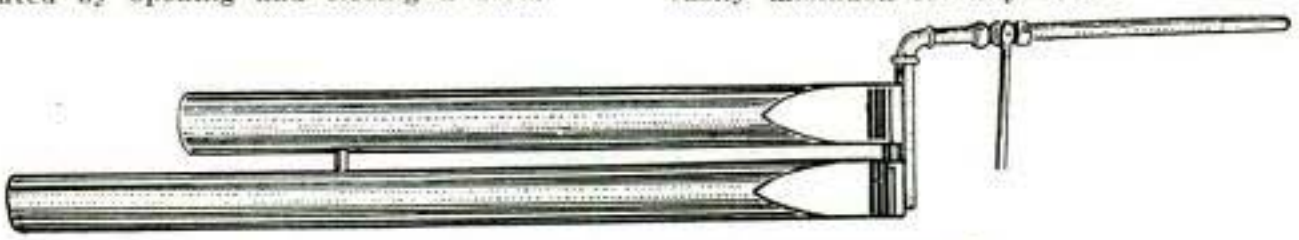
Warm Steering Wheel

PISTOL WATCH CHARM—Said to be the smallest pistol ever made. Made after the type of forefather's duelling pistols. Shoots a blank cartridge, which makes considerable noise but does no harm. Price 50 cents.

Pistol Watch Charm

WHISTLE GASOLINE ENGINE—A chime whistle which can be permanently attached to the exhaust pipe of gasoline engine in launch or automobile. Operated by turning the exhaust into the whistle by opening a valve worked with small lever.

The whistle acts instantly and can be heard a long distance. It gives an individual sound not easily mistaken for any other.



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One 200 H.P. 20x36-in R.H. box bed, with Meyer adjustable cut-off valve.

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MISCELLANEOUS.

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MISCELLANEOUS.—(Continued)

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WONDERFUL RESULTS from your Phonograph by using "TIZ-IT", because IT IS IT.

PATENTS FOR SALE.

We have clients who desire to sell all or part interests in the following new patents:—These inventions are practical and salable things, in most cases suitable for a mail order business, but the inventors are not in position to market same. They offer excellent opportunities to parties having small capital who wish to start or extend a manufacturing business.

BRACKET for supporting electric light wires. Costs 1c to make, retails for 10c. Made of brass and wood.

APPARATUS for automatically replacing burned out fuses in electrical apparatus. Suitable for concern manufacturing miscellaneous electrical novelties.

AN ELECTRIC WHIP, designed for use in place of the ordinary horse-whip. Gives animals a gentle shock, or a severe one if balky or lazy. Will cure balkiest horses. Is highly recommended, cannot be stolen, and will last a life time, so is cheaper than common whips.

CIGAR CUTTER AND MATCH IGNITOR to carry in vest pocket or on key ring. Can be made in nickel finish for 1½c, and is suitable for advertising device. Will retail for ten cents.

PIPE which can be cheaply manufactured, and frees tobacco from nicotine. Is neat and practical, and can be sold in competition with common pipes.

CUFF-BUTTON which holds the cuff in coat-sleeve. Is cheap to make, easy to apply, and nothing to get out of order.

BACHELORS' button, needle and thread holder. Every traveling man and college boy should have one. Sold by the best stores at 10c. A fine thing for mail order business.

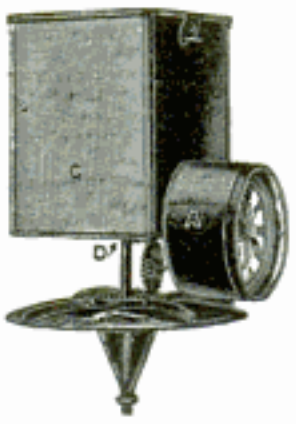
CARD TABLE having counting device attached, thus avoiding paper, pencil or slate. No chance to cheat or make mistakes in counting with this table. Suitable for manufacturer of tables or other furniture.

For full particulars address Patent Sales Department, Popular Mechanics, Journal Bldg., Chicago, Ill.

WANTED—Specialties to sell through agents. Manager, Box 373, Lowell, Mass.

A WELL-WRITTEN, neatly illustrated catalogue or booklet, sells goods. Manufacturer, let me figure on your new catalogue. Dan Knerr, Box 302, Hamilton, Ohio.

FEEDING POULTRY BY A CLOCK.



Feeding the chickens by means of a clock was the way an Englishman contrived to be absent from home several days without depending on the neighbors. A gear wheel connected with the clock turns a shaft extending into the box of grain and at intervals opens a shutter which allows the grain to drop. A is the clock; B the gear wheel operating the shutter; C the box; D the pipe through which the feed drops.

WOULD TIRE HIS JAWS.

A Cambridgeshire farmer was recently arguing with a French chauffeur, who had slackened at an inn, on the merits of the horse and the motor car.

"Give me a 'orse," remarked the farmer. "Them travelin' 'oilshops is too oncertain for me."

"Eet ees prejudice, my friend," the chauffeur replied. "You Engleesh are behind the times. You will think deefairent some day."

"Behind the times be blowed," came the retort. "P'r'aps nex' time the Proosians are around Paris, and you 'ave to git your dinner off a steak from the 'ind wheel of a moty car, you Frenchies'll wish you wasn't so jolly well up to date."—Birmingham (England) News.

CAUSES OF THE COLOR IN DEEP WATER.

The varied and varying colors of water, the rapid changes which occur even while we are watching them, has often puzzled older people than children. One of the most beautiful effects in these mysterious colorations are seen in that large, deep spring upon the grounds of the Castalian Club at Castalia, O., which is the source of one of the most perfect trout streams in the world. It is called The Blue Pool; the waters are as clear as crystal, and their depth twenty feet or more from the surface of the ground. The beautiful rich blue color, as is often seen in masses of water, is accounted for by the action of the suspended particles in the fluid upon the light traversing it. To understand how the color may vary, in this and other cases, it is only necessary to recall the composition of sunlight. When such light is passed through a triangular column of glass or optical prism it is broken up into the seven prismatic colors, viz., red, orange, yellow, green, blue, indigo and violet. When the light falls on water of sufficient depth it is also decomposed or broken up, the red rays of light are absorbed near the surface of the water and disappear, while the other colored rays pass to a greater depth, one after the other being lost in their proper order, as stated, until there is at last complete extinction of light if the water is free from solid particles. The presence of these particles, however, causes a part of the light to be reflected, and according as this reflected light has come from various depths, so will the color vary.

An experiment of interest to illustrate this may be easily tried. A white plate attached to a cord of the proper length may be thrown into the sea from the bow of a moving vessel, and when it reaches the point of observation at the stern, in every instance the plate will appear of a green color, although the water may be of a deep blue.

JUST TURN TO AND DIG.

Silas Snodgrass was a farmer
As lived up in San Joaquin,
And about him folks kept saying—
"Curious feller ever seen;"
But he always had the best crops
And rode in a bang-up rig,
And he 'lowed the way he did it
Was to jest turn to and dig.

Didn't waste much time er talking,
"Hedn't none to spare," sez he,
But through all his words there always
Ran his quaint philosophy.
If youd ask him howsomever
He raised 'taters quite so big
He'd say: "Well, thet's very simple,
If you jest turn to and dig."

Didn't talk much 'bout his neighbors,
Seemed to take a cheerful view;
Ask him how he was successful;
This is what he'd say to you—
"You can raise the best potatoes,
You can own the finest pig
And the best corn crop a-goin'
If you jest turn to and dig.

"People," sez he, "think I'm lucky,
Cour'us how some folks can't see;
Good hard work and plenty of it
'Sall the luck I claim, by gee!
Makes no difference what yer tackle,
Whether things be small er big,
One thing sure, you'll be successful,
If you jest turn to and dig."

—Harry T. Fee.

PAINT AS A PROTECTION FOR FRUIT TREES.

Fruit trees painted with pure white lead and linseed oil are said, by Professor Atwood of the Virginia Experiment Station, to be well protected against insects, borers and scale, and that this practice will make nursery trees proof against harm by rabbits.

This practice has been opposed by other horticulturists, but the Professor's object lesson is an orchard of 13,000 trees, seven years old, and painted every year from the time set out. The trees are in a fine, thrifty condition.

$1,200 a Year for Life

Secured by Small Monthly Payments

The scientific cultivation of crude rubber is the most profitable enterprise of modern times. Because the price of rubber doubled in a decade and the total extinction of the virgin rubber trees of the world became a certainty for the near feature, the greatest horticulturists in America and Europe have given their attention to the cultivation on scientific principles of this great necessity of present day civilization. The semi-tropical regions of Mexico were selected for the purpose. There the virgin rubber trees have been ruthlessly destroyed by the improvident natives, and the white men who employed them saw no necessity of preserving the trees for annual tapping, as their number seemed inexhaustible. In that climate the rubber tree can be cultivated just as simply and just as surely as the sugar maple can be grown in Vermont, and can be tapped year after year at an immense profit. The destruction of the virgin tree still goes on in the South American jungles, where the natives are now forced to seek them at an added outlay of time and money, and where no white man can live to restrain them. The present inadequate supply of crude rubber comes almost entirely from this precarious source. It is inconceivable that the production of one of the great necessities of mankind can longer remain in such ignorant hands.

There is nothing speculative about Crude Rubber. It can be sold every day in the year, in every market in the world, and at a stable price that has been steadily advancing for many years.

The Mutual Rubber Production Company was one of the first to engage in this new and immensely profitable industry on a large scale. Years ago our managers purchased from the Mexican Government over 6,000 acres of land in the heart of Chiapas, the most tropical and fertile State of Mexico. No similar tract is available to-day for less than five times what we paid for ours. Thus the remarkable opportunity is now open to you to secure an interest upon the most favorable terms, in an enterprise that is destined to revolutionize the production of one of the world's greatest staples. No industry ever underwent so radical a development as that in which we are now engaged without making immensely wealthy all those who were interested in the change.

This splendid domain is now fast becoming a great commercial rubber orchard, conducted upon the most scientific principles of modern forestry and under Anglo-Saxon supervision. There are 6,000 shares, each share representing an undivided interest equivalent to an acre of land, planted to rubber trees and brought into bearing, and the price of these shares is $288 each. No large cash-down payment is required to secure them, however, as the shares are paid for in small monthly installments just as the work of development progresses. Thus the man or woman who wishes to secure a safe and certain income for future years, and who is able to save now a few dollars each month, is on the same footing in rubber cultivation as the mightiest capitalist, for wealth alone cannot force the soil.

For example, suppose you buy five shares (equivalent to five acres). You pay $20 a month for twelve months, then $15 a month for twelve more months, then $10 a month for a limited period until you have paid the full price for your five shares, $1,440—or $288 per share.

But meantime your dividends will have amounted to $1,050, or $210 per share. Hence the actual net cost of your five shares, or acres is $390, or $78 each. We secure these early dividends by planting 600 trees to each acre, and then "tap to death" 400 of them before maturity, getting every ounce of "rubber milk" from them. The dividends secured from the sale of this rubber are sufficient to pay your total money nearly all back before maturity, and then there will be left standing upon each acre 200 trees; and this is the normal number for the permanent yield. These 200 trees will each give at least two pounds of crude rubber per year for more years than you can possibly live. This rubber at 60 cents per pound net profit means a total profit of $240 a year on each acre, or $1,200 a year on your five acres. These figures are not "paper estimates" and they are not ours. They are vouched for by the most reliable sources of information in the world, the Government reports of the United States and Great Britain. Of course if you buy 10 shares your income would be $2,400 a year; or 25 shares will yield you $6,000 annually.

Five Acres, or Shares, in our Rubber Orchard planted to 1,000 Rubber Trees will at maturity yield you a sure and certain income of $100 a month for fifty or more years, and your dividends will average 25 per cent. during the period of small monthly payments.

Every possible safeguard surrounds this investment. The State Street Trust Co., of Boston, holds the title to our property in Mexico as trustee. We agree to deposit with them the money paid in for shares, and we file with them sworn statements as to the development of the property. This company also acts as registrar of our stock. You are fully protected from loss in case of death or in case of lapse of payments, and we grant you a suspension of payments for 90 days any time you may wish. Furthermore, we agree to loan you money on your shares.

We can prove to you that five shares in this safe and permanent investment, paid for in small monthly installments, will not only bring you **an average return of 25 per cent. on your money during the period of payment,** but will then bring you **$100 a month for more than a life time.** Send us at once $20 as the first monthly payment to secure five shares, $40 for 10 shares, $100 for 25 shares—$4 per share for as many shares as you wish to secure. Our literature explains our plan fully and concisely and proves every statement. It will be sent to you immediately on request.

Mutual Rubber Production Company

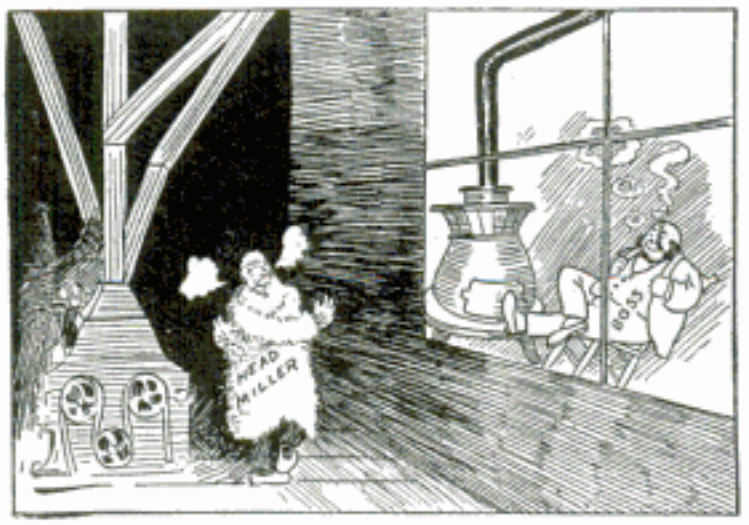
91 Milk Street, Boston, Mass.

PROOF COINS—HOW THEY ARE MADE AT THE U. S. MINT.

The proof coins of the mint are made in gold, silver, nickel and bronze, a complete set of which will cost the purchaser exactly $41. There are but three sets of coins that can be bought at mint for collections. Each coin is struck on a screw press, operated by hand, from a specially polished die, and only polished blanks are used; these are absolutely flawless.

Every portion of each die is most clearly brought out, and when such a collection is appropriately mounted and framed it is a very attractive one.

The series of gold coins can be bought for $38.50, which includes the $20, $10, $5 and $2.50 pieces. The $3 coin, one of the most artistic ever coined by the mint, is not now circulated, and is not included in any collection sold by the mint. The silver coins include the denominations of dollar, half dollar, quarter and dimes, and are sold with the nickel five cent pieces, and bronze cent for the total sum of $2.50. The nickel and cent coins are sold separately, if desired, for eight cents.



Economical Plan of Heating the Mill.

With this arrangement the boss can keep perfectly warm in the office and the miller can get hot (under the collar) on the mill floor.—American Miller.

FOR SALE.

REPAIR SHOP for sale; building and tools; repairing bicycles, guns, sewing machines, typewriters, etc.; large trade. For particulars write Lock Box 65, Toledo, Iowa.

FOR SALE—One show case, 10 feet by 26 inches by 24 inches; one Reliable feed cooker; two Box Ball alleys; one pool and one billiard table; one cigar case; one Gassole cigar lighter. Write J. D. McHenry, Dana, Ill.

FOR SALE—150 acres; the best farming proposition in the best farming section of South Florida, including famous old bearing orange orchard, etc.; high, healthy, rich soil, where you can grow a winter garden and enjoy life outdoors every day. O. K. title; bargain for cash; price, $20 per acre; quick. Address D. C. Green, Box 577, Barlow, Fla.

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When you buy a Wing Piano you buy at wholesale. You pay the actual cost of making it with only our wholesale profit added. When you buy a piano as many people do—at retail—you pay the retail dealer's store rent and other expenses; you pay his profit and you pay the commission or salary of the agents or salesmen he employs.

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We will place a Wing Piano in any home in the United States on trial without asking for any advance payment or deposit. We pay the freight and other charges in advance. If the piano is not satisfactory after 20 days' trial in your home we take it back entirely at our expense. You pay us nothing and are under no more obligations to keep the piano than if you were examining at our factory. There is absolutely no risk or expense to you. Old instruments taken in exchange.

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Instrumental Attachment imitates perfectly the tones of the mandolin, guitar, harp, zither, and banjo. Music written for these instruments, with and without piano accompaniment, can be played just as perfectly by a single player on the piano as though rendered by an orchestra. The original instrumental attachment has been patented by us and it cannot be had in any other piano.

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37th Year—Established 1868

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For Liquozone, Yet We Give You a 50c Bottle Free.

We paid $100,000 for the American rights to Liquozone; the highest price ever paid for similar rights on any scientific discovery. We did this after testing the product for two years, through physicians and hospitals, in this country and others. We cured all kinds of germ diseases with it—thousands of the most difficult cases obtainable. We proved that in germ troubles it always accomplishes what medicine cannot do. Now we ask you to try it—try it at our expense. Test it as we did; see what it does. Then you will use it always, as we do, and as millions of others do. You will use it, not only to get well, but to keep well. And it will save nearly all of your sickness.

Kills Inside Germs.

Liquozone is not made by compounding drugs, *nor is there alcohol in it.* Its virtues are derived solely from gas—largely oxygen gas—by a process requiring immense apparatus and 14 days' time. This process has, for more than 20 years, been the constant subject of scientific and chemical research.

The result is a liquid that does what oxygen does. It is a nerve food and blood food—the most helpful thing in the world to you. Its effects are exhilarating, vitalizing, purifying. Yet it is a germicide so certain that we publish on every bottle an offer of $1,000 for a disease germ that it cannot kill. The reason is that germs are vegetables; and Liquozone—like an excess of oxygen—is deadly to vegetal matter.

There lies the great value of Liquozone. It is the only way known to kill germs in the body without killing the tissues, too. Any drug that kills germs is a poison, and it cannot be taken internally. Medicine is almost helpless in any germ disease. It is this fact that gives Liquozone its worth to humanity. And that worth is so great that we have spent over one million dollars to supply the first bottle free to each sick one we learned of.

Germ Diseases.

These are the known germ diseases. All that medicine can do for these troubles is to help Nature overcome the germs, and such results are indirect and uncertain. Liquozone attacks the germs, wherever they are. And when the germs which cause a disease are destroyed, the disease must end, and forever. That is inevitable.

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Abscess—Anaemia
Bronchitis
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Coughs—Colds
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Colic—Croup
Constipation
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Dysentery—Diarrhea
Dandruff—Dropsy
Dyspepsia
Eczema—Erysipelas
Fevers—Gall Stones
Goitre—Gout
Hay Fever—Influenza
Kidney Diseases
La Grippe
Leucorrhea
Liver Troubles
Malaria—Neuralgia
Many Heart Troubles
Piles—Pneumonia
Pleurisy—Quinsy
Rheumatism
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Tuberculosis
Tumors—Ulcers
Varicocele
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50c. Bottle Free.

If you need Liquozone, and have never tried it, please send us this coupon. We will then mail you an order on a local druggist for a full-size bottle, and we will pay the druggist ourselves for it. This is our free gift, made to convince you; to show you what Liquozone is, and what it can do. In justice to yourself, please, accept it to-day, for it places you under no obligation whatever.

Liquozone costs 50c. and $1.

CUT OUT THIS COUPON

for this offer may not appear again. Fill out the blanks and mail it to The Liquozone Company, 458-464 Wabash Ave., Chicago.

My disease is.....

I have never tried Liquozone, but if you will supply me a 50c. bottle free I will take it.

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.....

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763 Give full address—write plainly.

Any physician or hospital not yet using Liquozone will be gladly supplied for a test.

NOTHING CAN BE FAIRER THAN THIS

WE SHIP DIRECT FROM OUR FACTORY TO YOU A RANGE OF YOUR SELECTION AND

YOU DON'T PAY A CENT

except the freight. Keep your money until we prove that we have what you want. So widely popular are **Tolman Steel Ranges,** *so perfect in baking, so economical in fuel, that we are not afraid to trust to your honor. We will ship direct to your address, absolutely without a cent being paid to us, any one of our* **Tolman Steel Ranges** *shown in catalogue E. You pay the freight—nothing more—take the range home, put it up in your house, bake with it, watch how little wood or coal you need, try it thoroughly in every way. When you are convinced it is a bargain and just what you want, send us the money, the price as shown in catalogue. If the Range fails to come up to our description, send it back to us at our expense.* **Tolman Steel Ranges** *have been on the market for twenty years and there is no Range on earth that gives better satisfaction. They are made of best wrought cold rolled locomotive boiler steel, strongly riveted, oven plates braced, flues lined with asbestos, perfect bakers, guaranteed five years. The Range shown in this cut is one of our leaders and cannot be had of your local dealer for less than about $50.00. We sell it on above conditions for $28.75. For a trifle extra* **you can pay in weekly or monthly payments** *if you wish. Send order to-day, or if you prefer to make selection, send for our beautiful catalogue E. Mention this magazine in order to get Range on above terms.*

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Dear Sir:—Would you be open for an investment which will yield, with reasonable assurance, from 50 per cent to 100 per cent each year?

It will average 75 per cent—which means 6¼ per cent a month.

When I say investment, please understand that I do not mean a gambling proposition, such as stocks and grain speculation, or horse-race betting, nor anything which requires you to buy what you do not want, or sell what you have not got.

I REFER TO A STRAIGHT INDUSTRIAL PROPOSITION, which has for its commodity products produced by nature, and in turn manufactured into commercial necessities, for which the demand always exceeds the supply.

As a representative business man, I fully realize the annoyance of receiving unsolicited literature and advertising matter of unknown propositions.

Therefore, before placing before you, in full detail, the venture I refer to, I ask your consent, and for that purpose I attach this coupon, which explains itself. If agreeable, and you are open for a proposition which will produce all that I claim, kindly sign and mail it.

THIS COSTS YOU NOTHING BUT THE POSTAGE, AND PUTS YOU UNDER NO OBLIGATION.

In closing, permit me to say, that the men at the head of the corporation which I represent are men of great wealth and undisputed commercial integrity.

There is not a single questionable feature in the entire plan.

May I hope to hear from you by return mail?

Very sincerely,

L. C. WELTON, 59 Clark St., Chicago.

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Dear Sir:—You may send to my address full details of the proposition you refer to. I will carefully consider the matter, and, if interested, will write you further. This with the distinct understanding that I am under no obligations.

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